ENGINEERING AND
BOILER HOUSE REVIEW

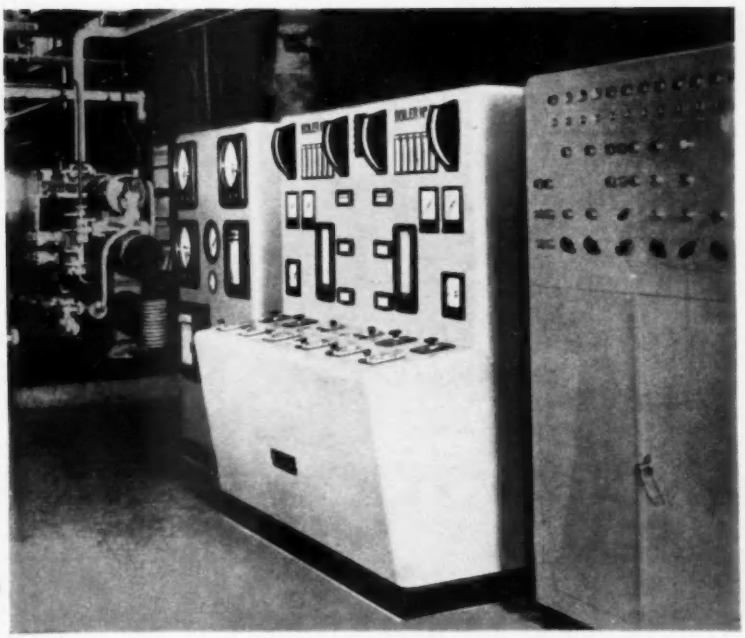
ESTABLISHED 1899

ONE SHILLING & SIXPENCE

VOL. 75 NO. 4 • THE PIONEER STEAM JOURNAL • APRIL, 1960

Electroflo
Meters & Controls

A TYPICAL 'profit making' INSTALLATION



2—B. & W. W.T. Boilers, oil fired, with Thornycroft burners M.C.R., 28,000 lb./hr., 400 p.s.i.g. @ 700° F. Further particulars on application

This boiler plant costs less to run and maintain because — through Electroflo Automatic Boiler Control — it operates continuously at optimum efficiency.

The initial capital cost of Electroflo Automatic Control is invariably recovered within a few months of starting up. For further particulars, ask for Publication No. S.849.

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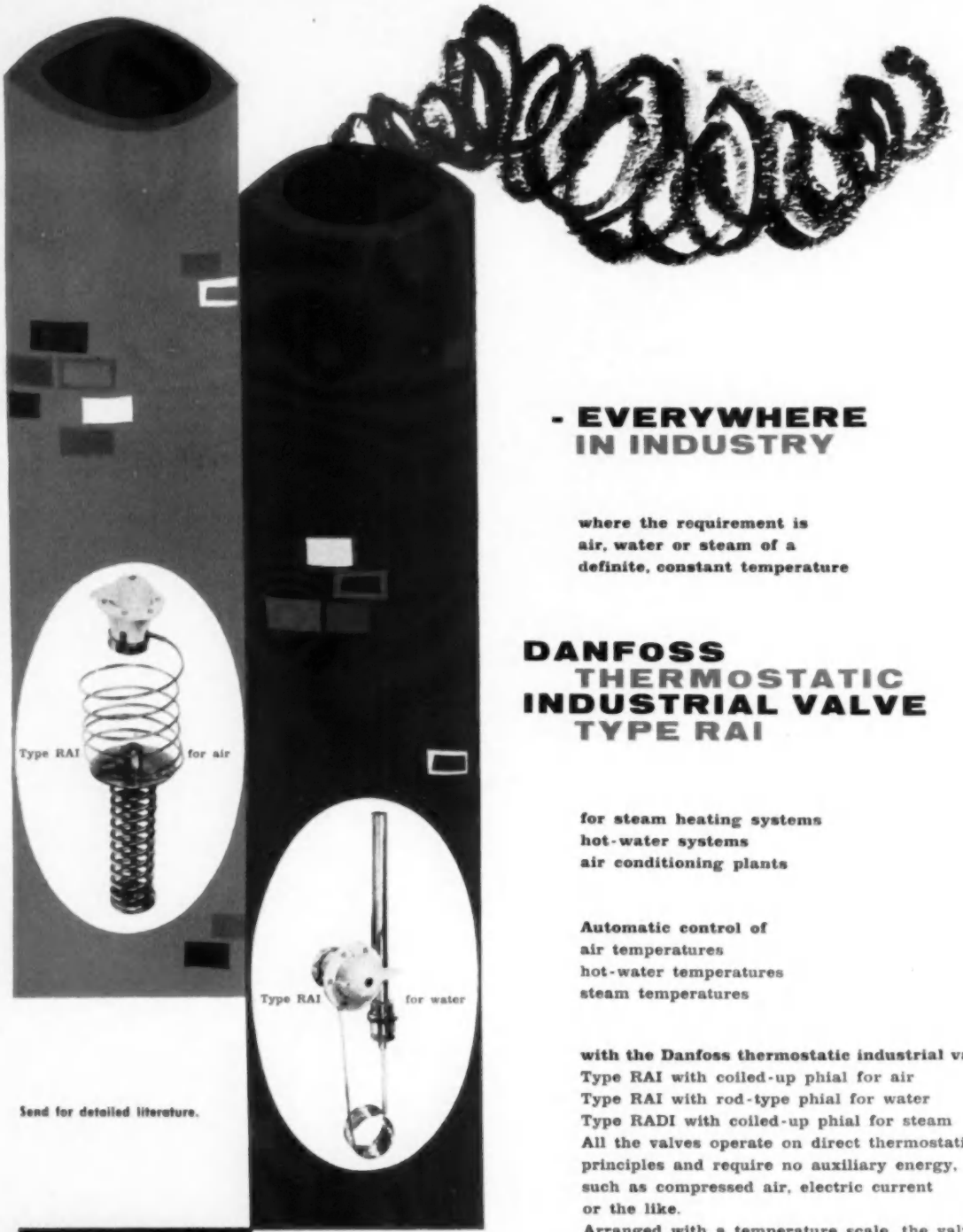

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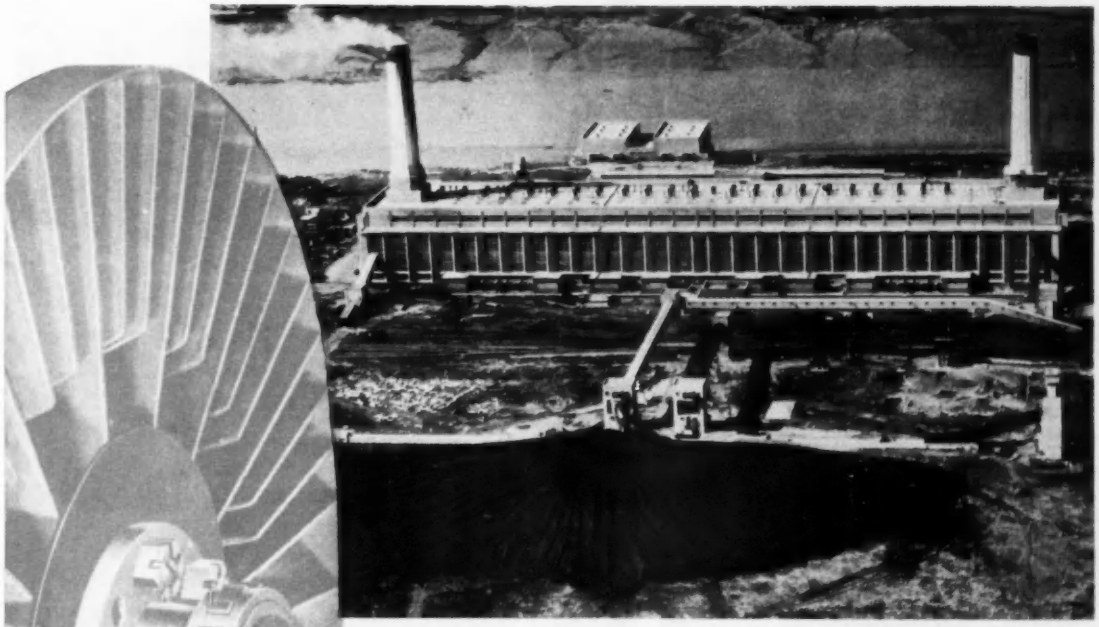

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PAL 14D.

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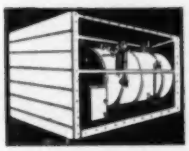
STEAMBLOC the best packaged boiler

And no wonder! Only Steambloc automatic packaged boilers are backed by such vast technical and research facilities. These are provided by the Babcock & Wilcox organisation, acknowledged world leaders in boiler-making.



Steambloc boilers pack many **exclusive** *features:*

- burn heaviest oils without major modifications
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- longer boiler shell eliminates overheating of rear tube plate, allows greater flexibility
- patent twin rear door gives easier access
- quick-release clear-out port at bottom of front gas pass
- spill type pressure oil burner with no moving parts

Steambloc boilers are available with capacities up to 25,000 lb/hr. in two pressure ranges—up to 145 and up to 245 p.s.i.

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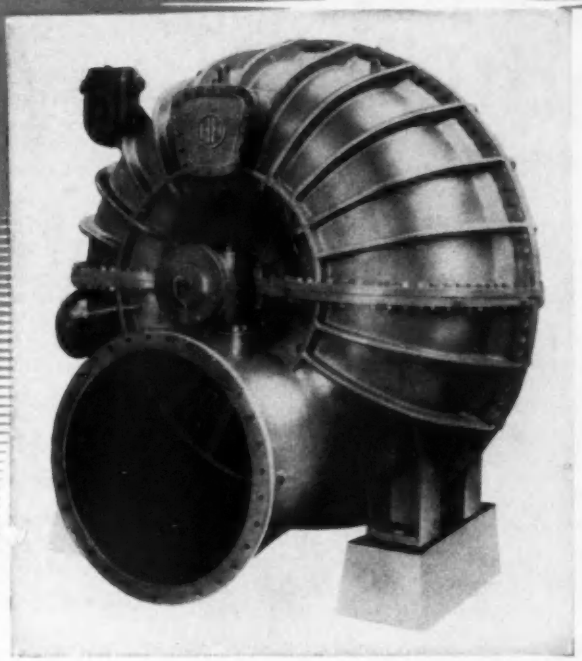

Rotary Water Strainers

Size "N" for 3,500,000 g.p.h.

The Hick Hargreaves self-cleaning enclosed Rotary Water Strainer is proving, in service throughout the world, to be the most effective means of removing floating debris. The strainer comprises a motor driven wheel, slowly rotating inside a casing, the straining medium which is between the spokes being so designed to prevent the interlacing of fibrous matter. The head loss through the strainer does not exceed 2 feet. The debris is removed from the strainer by a series of jets, and discharged from an internal chamber which is effectively sealed off from the main water space. All water connections are placed in the lower half of the casing and large access doors are provided for routine examination. Installation is extremely simple, no extensive foundation work being necessary. The strainer can be located on either the suction or discharge side of the circulating water pumps.

The Hick Hargreaves Rotary Strainer is available in a range of capacities up to 5,000,000 g.p.h. with mesh of $\frac{1}{16}$ in. to $\frac{1}{4}$ in. diameter inscribed circle.

Hick Hargreaves

AND COMPANY LTD · BOLTON

H.1391B

Electronic PROTECTORELAY

checks itself!

New Honeywell Protectorelay brings electronic 'Mastermind' control to both *gas and oil* burning installations... adds component check to basic flame safeguard functions

Component check means added safety. Before power supply is resumed to a shutdown burner, Honeywell's Protectorelay checks the control system for flame simulating faults. If these are present, it prevents burner operation.

Electronic speed, electronic sensitivity ensure that flame failure is sensed immediately it occurs.

A temperature compensated safety switch shuts down the burner following a trial ignition period.

Honeywell design, Honeywell ease of installation extends electronic safety control to oil or gas fired boilers and furnaces. The Protectorelay will tolerate up to 300 ft of *unscreened* lead with a photocell and up to 100 ft with a flame rod.

For use with Flame Rods, Photocells, Ultra-Vision

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First in Control

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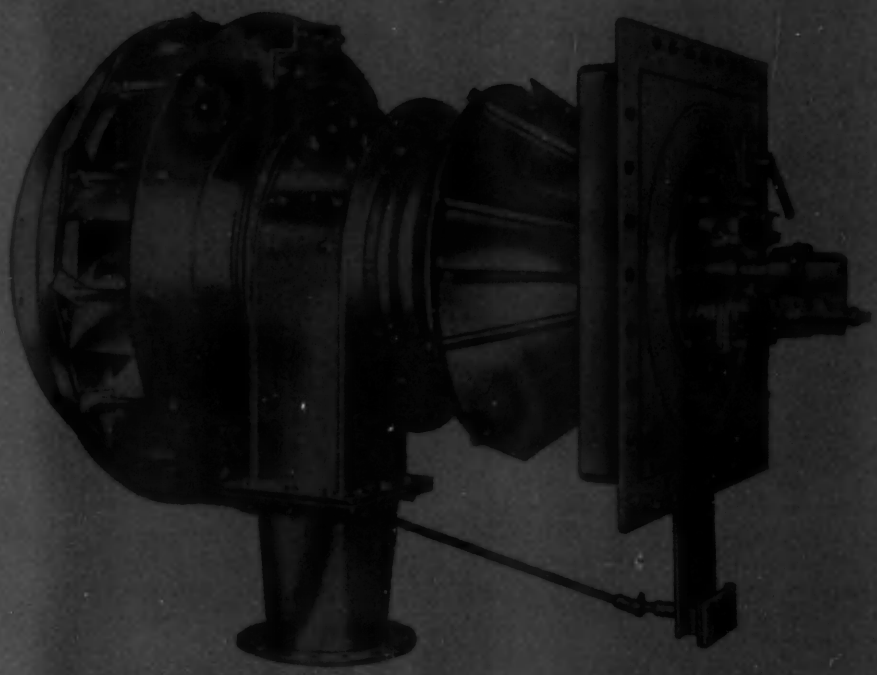
PEABODY
MULTI-FUEL BURNERS



for a steam output over 150,000 lb/hr. per burner

PEABODY multi-fuel burners are manufactured in a range of sizes up to 250 million B.T.U./hr., for use with pulverised coal, heavy fuel oil and high pressure gas, either singly or in any combination. The new N.T. multi-fuel burner illustrated will be displayed on our stand 6F in the Grand Hall at the

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For process use . . . PEABODY direct fired air heaters provide hot air and inert gases.

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PERMUTIT WATER TREATMENT

All Boilers need Good Feedwater

THE CONTROL PANEL on the opposite page will do an important job at the Carrington Works of the Shell Chemical Company Limited: it will control the fully automatic Permutit plant producing nearly a million gallons daily of very pure water for high pressure boilers.

This and similar plants designed and manufactured by Permutit emphasize the vital importance of correct boiler feed treatment, not only for highly rated steam generators, but also for boilers working at medium and low pressures.

In the extreme pressure range, the only tolerable feedwater is one free from dissolved solids, with almost unmeasurable silica and an electrical conductivity of less than 0.5 micromhos per cm3. Water to this high standard is produced cheaply, in any quantity, by "Deminrolit" mixed bed ion exchange plant.

For intermediate pressures, the feed must be completely free from scale-forming matter, with controlled alkalinity and reduced dissolved solids. Partial demineralising by the Permutit "Starvation"-Base Exchange process produces make-up of this type.

With boilers used for heating or low process steam production, scale on any of the heating surfaces or in economizers and pre-heaters wastes fuel and increases the cost of maintenance. The feed must therefore be zero soft: this is ensured by Permutit Base Exchange softening.

To eliminate dissolved gases from feed water and prevent corrosion, the Permutit de-aerator — operating with exhaust steam — reduces oxygen to less than 0.03 cc per litre.

For low running costs, easy maintenance and consistent steam production, boilers need the best possible feed water. Selecting the plant to give the right treatment is a specialist's job that can be safely left to Permutit.

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SUPPLIERS OF WATER
TREATING EQUIPMENT
TO THE LATE KING GEORGE VI

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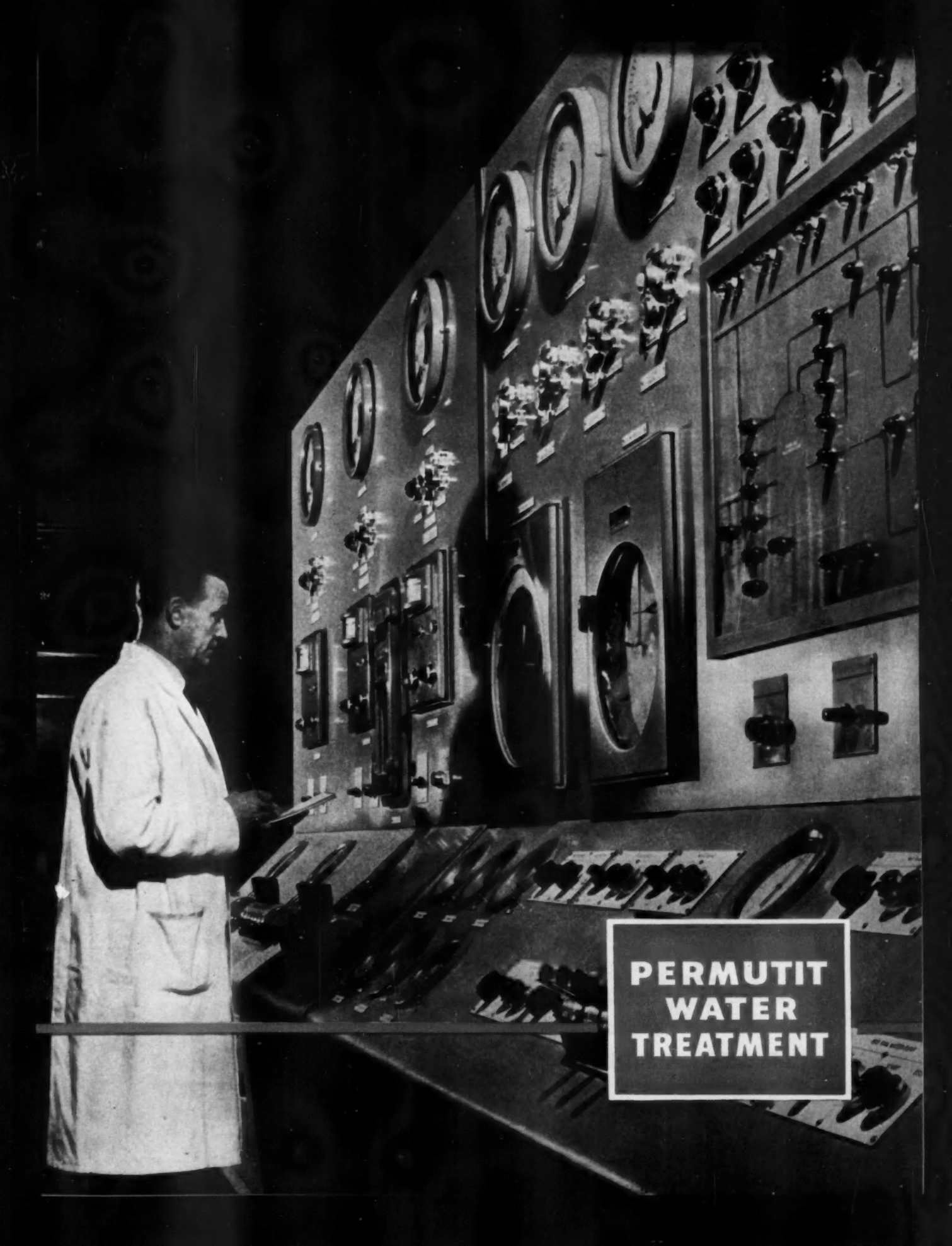
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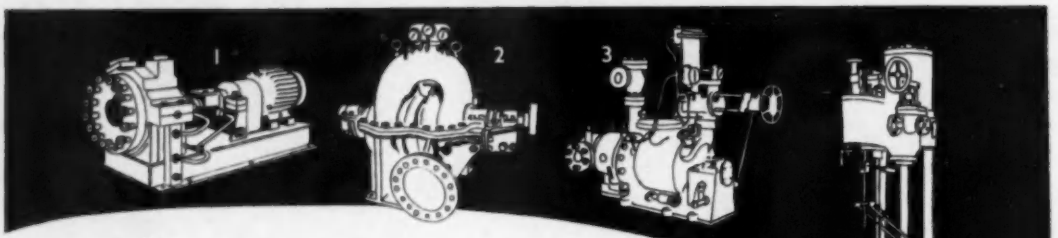

the pump you need...

. . . standardised from our extensive range or, if you have a special problem, designed to your needs.
For instance, the pumps shown in illustrations No's. 1 and 5 were custom-built to special requirements.

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3 TWO STAGE TURBO FEED PUMP
4 VERTICAL DIRECT ACTING FEED PUMP
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P4749

COAL-Mechanical Stokers

and the

CLEAN AIR ACT

As recently announced in the press, a new ministerial order permits the installation of mechanical coal burning equipment in Smoke Control Areas. It follows that the most modern and efficient plant should, of course, be installed on the lines of the latest Hodgkinson boiler house equipment.

"METERFEED" UNDERFEED STOKER

This stoker has separate drive and fan motors which our "Custodian" Panel controls by cutting in the fan at a predetermined period before the drive and cutting out the fan after the drive has stopped.
The "Meterfeed" Underfeed Stoker is designed for the utmost fuel economy **without smoke** and is available in a full range of sizes in both hopper and bunker feed models and suitable for boiler, kiln and furnace application. All models embody the controlled feed principle.

NEW "CUSTODIAN" CONTROL PANEL

The combination of the "Custodian" panel with the "Meterfeed" Underfeed Stoker operates as a highly efficient guarantee against the production of smoke and its consequences under the Clean Air Act.

NEW HODGKINSON 8" UNIVERSAL COAL ELEVATOR

- ★ *Entirely new concept of simple design*
- ★ *Elevates at any angle between 60° and vertical*
- ★ *Easy assembly in a matter of hours*
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- ★ *Low initial cost and low maintenance*

The elevators in this range are made up from standard parts available from stock.

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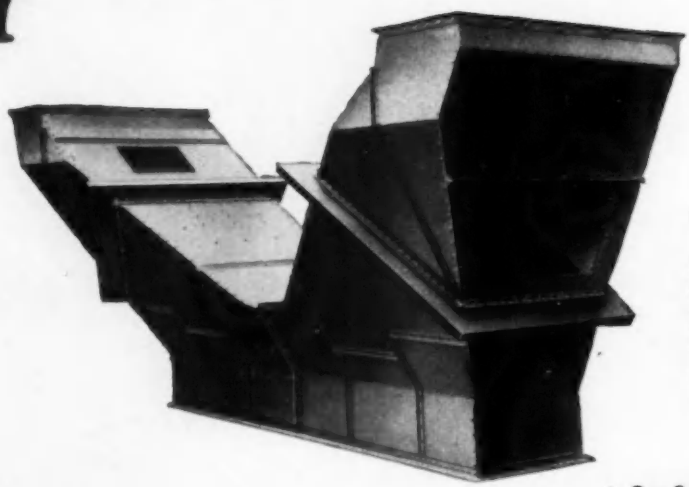

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Ducts of rectangular design for power stations or boiler houses, of electrically-welded construction in Mild or Special Steels or Aluminium Alloy, can also be supplied. They are accurately fabricated to suit your exact requirements.

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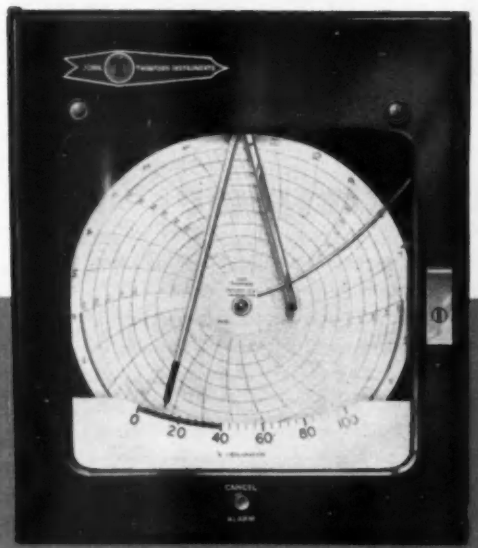
SMOKE DENSITY RECORDING and FLOWMETERS

Sentinel Series

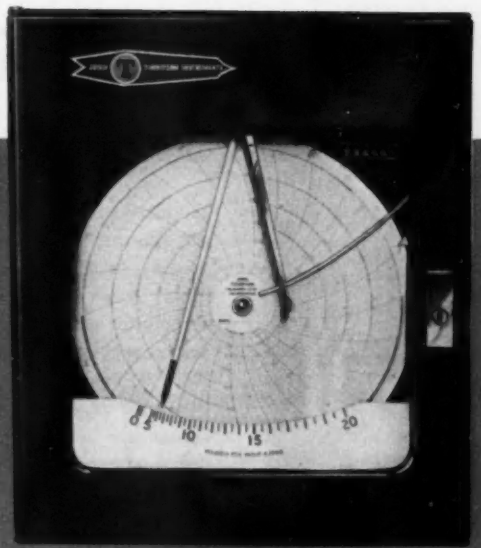
The illustrations show two of the comprehensive series of "Sentinel" Instruments. Below left, is the Smoke Density Recorder and Indicator which provides a reliable and inexpensive means of meeting the requirements of the Clean Air Act 1956, and at the same time serves as a guide to efficient combustion.

Below right, is the "Sentinel" Flow Meter. available in a variety of forms for measurement and recording of flow of steam, air gases and liquids. If required, pressure and temperature measurement can be incorporated in the same instrument.



Above: Smoke Density Recorder and Indicator with warning lamps: a warning klaxon or other remote alarm system is incorporated, and can be used to operate any type of alarm system.

Below: The recording, integrating and indicating meter is available with pressure compensation, remote electrical transmission and the combination of three measured variables, i.e. flow, pressure and temperature.



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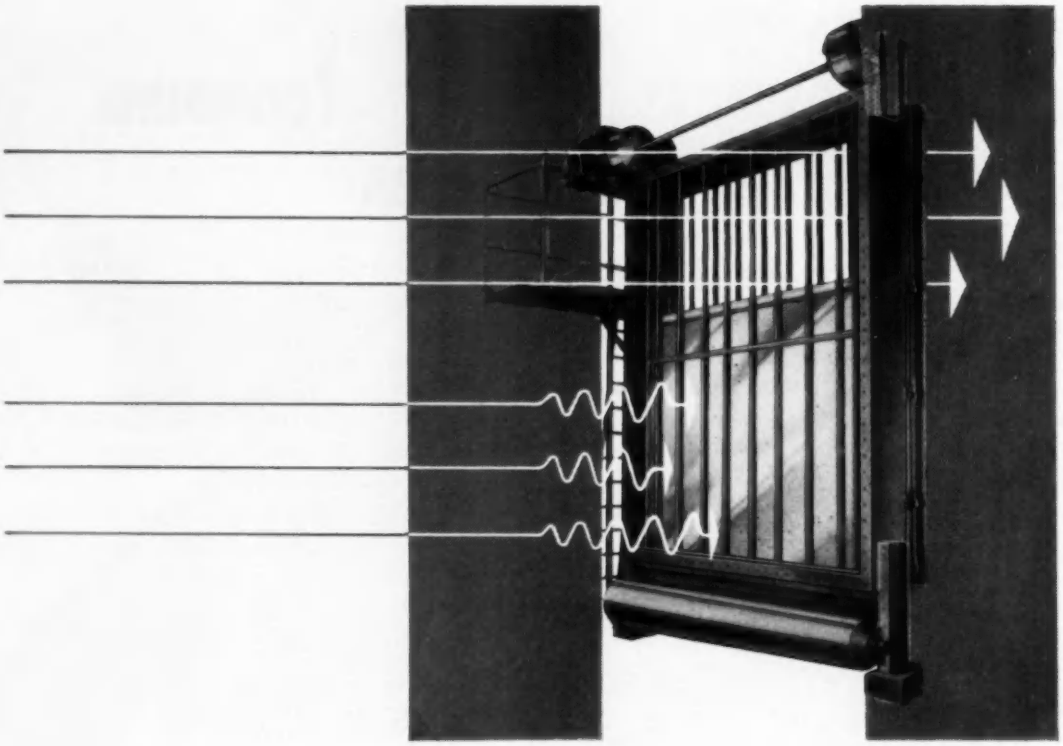

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AT LONG LAST . . . a Damper to meet with the conditions in Boiler and Power Station Flues and yet require the minimum of maintenance. The well-known difficulties of traditional arrangement are overcome with the Dowling Damper which provides an economical and reliable seal between flue sections of all sizes. It is designed and constructed to withstand varying conditions of temperature, gas pressure, acids and dust that are prevalent in Boiler and Power Station Flues. It can be hand operated or power driven and supplied with air-operated seals if required.

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Enquiries are invited for application in new Power Station projects, Boiler House installations and other applications in the Gas, Chemical, Cement and other industries where the control of hot gas and dust is required in ducting systems and chimneys. Write for fully descriptive leaflet to:

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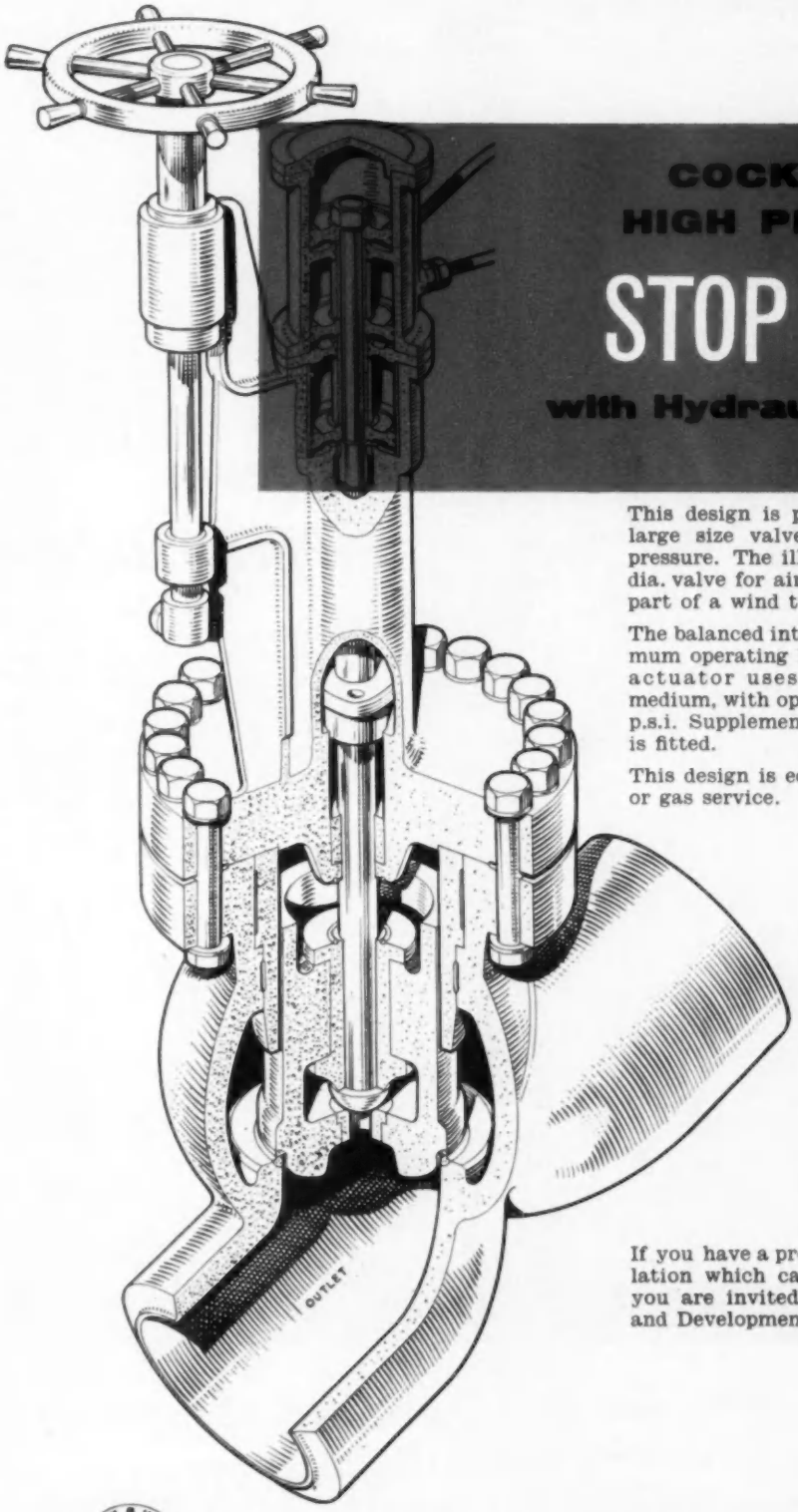

COCKBURN'S HIGH PRESSURE

STOP VALVE

with Hydraulic Operation

This design is particularly suitable for large size valves operating under high pressure. The illustration is of an 18 in. dia. valve for air service at 3,500 p.s.i. as part of a wind tunnel installation.

The balanced internals guarantee a minimum operating load. The Lockheed type actuator uses oil as the hydraulic medium, with operating pressure of 2,000 p.s.i. Supplementary hand-wheel control is fitted.

This design is equally applicable to fluid or gas service.

If you have a problem of control or regulation which can be solved by a valve, you are invited to contact our Design and Development Section.

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COCKBURNS (NEDERLAND) N.V., KETHEL SCHIEDAM HOLLAND

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66,000 HOURS' PRECIPITATION

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★ The three boilers have completed a combined steaming time of 66,000 hours.

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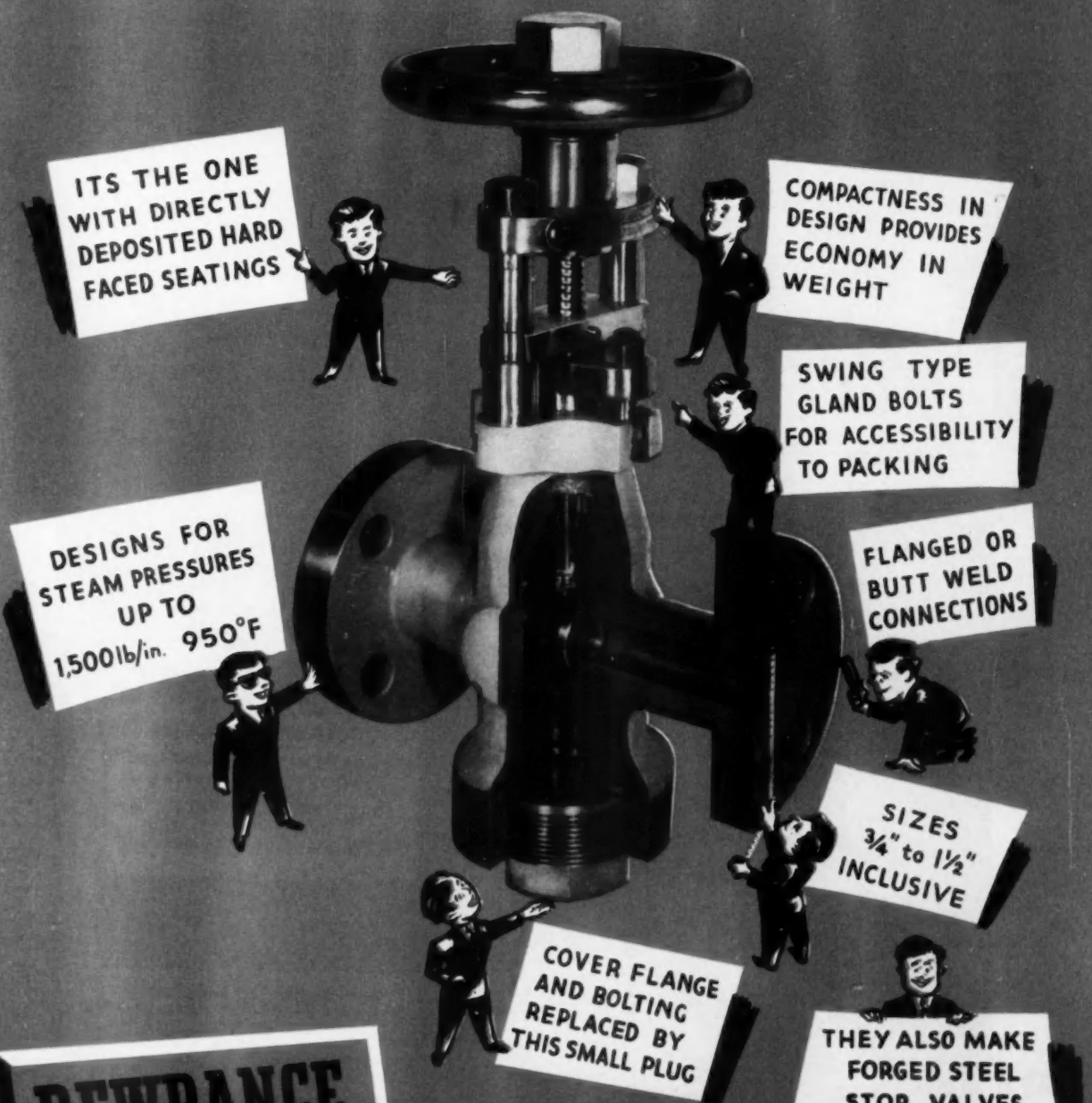
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GAS WORKS, COKE OVENS, BOILER PLANT, STEEL AND CHEMICAL WORKS AND INDUSTRIAL PLANTS GENERALLY.

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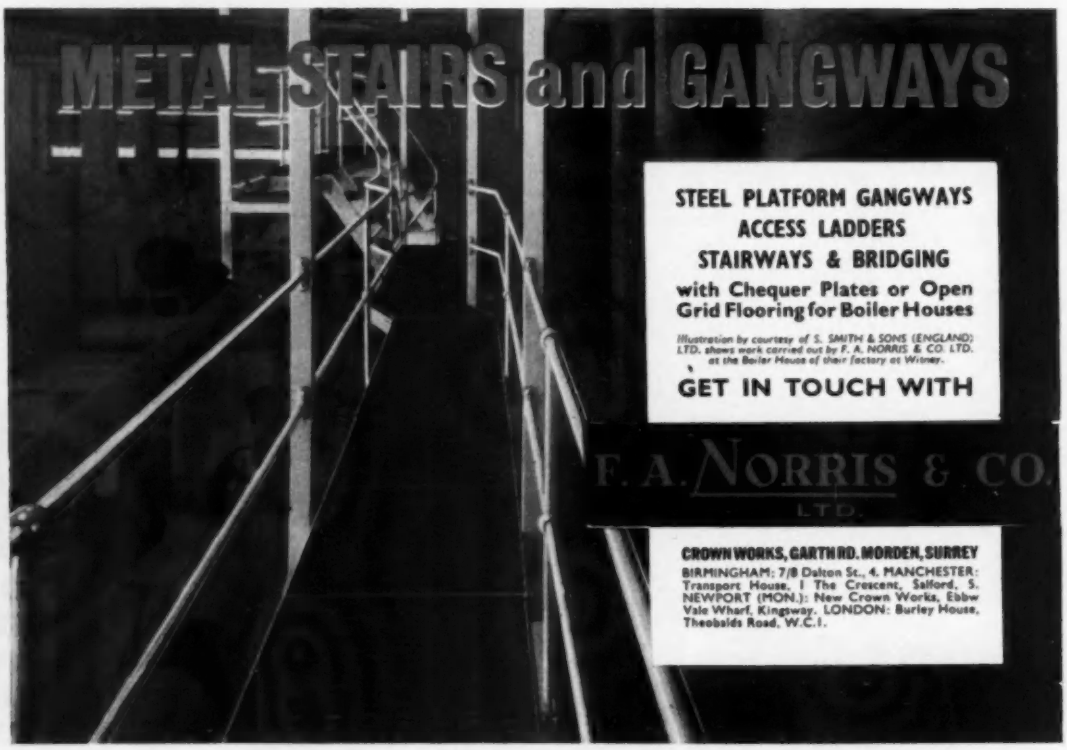
METAL STAIRS and GANGWAYS
STEEL PLATFORM GANGWAYS
ACCESS LADDERS
STAIRWAYS & BRIDGING
with Chequer Plates or Open Grid Flooring for Boiler Houses
Illustration by courtesy of S. SMITH & SONS (ENGLAND) LTD. shows work carried out by F. A. NORRIS & CO. LTD. at the Boiler House of their factory at Witney.
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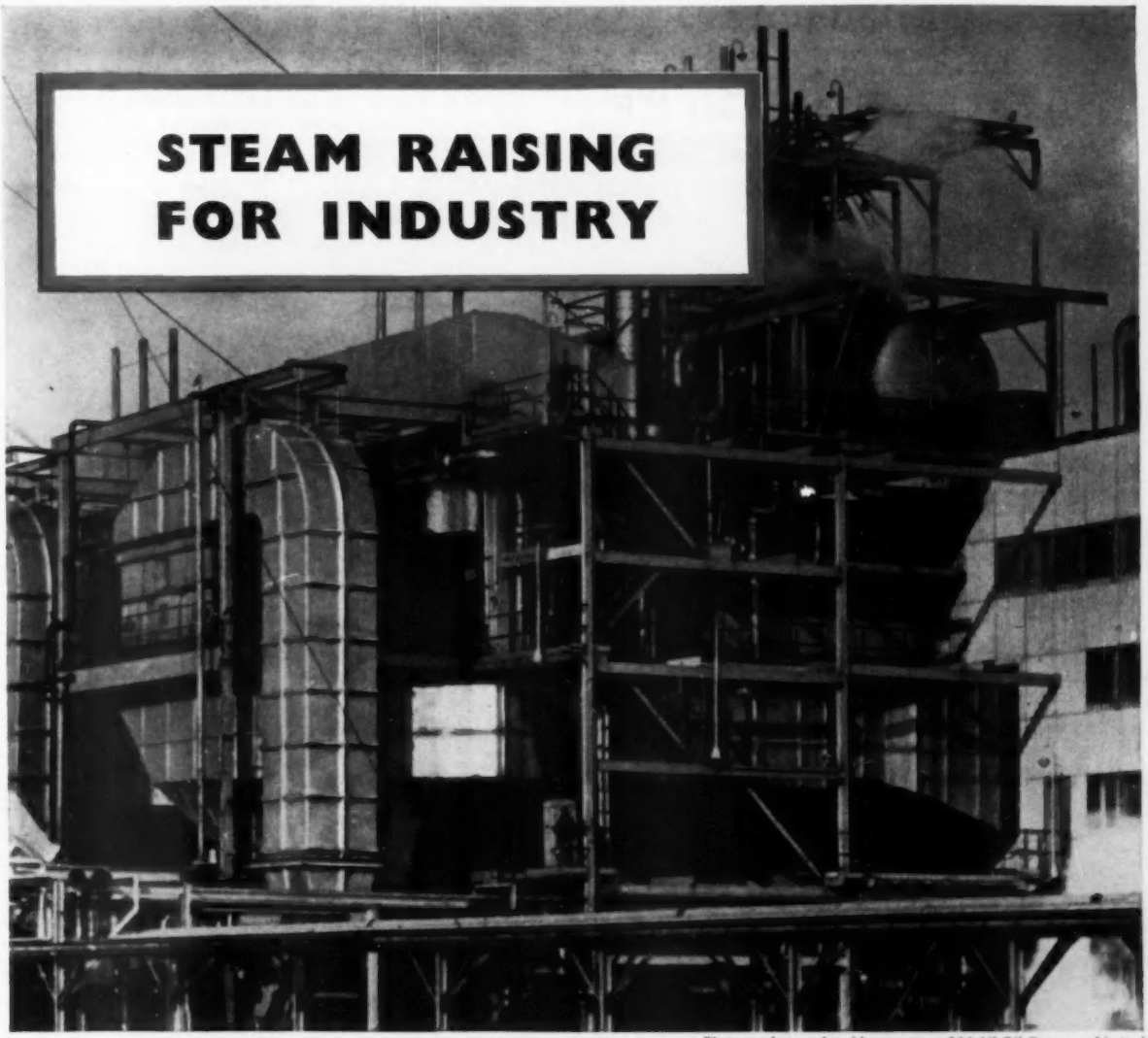
BIRMINGHAM: 7/8 Dalton St., 4. MANCHESTER: Transport House, 1 The Crescent, Salford, 5. NEWPORT (MON.): New Crown Works, Ebbw Vale Wharf, Kingsway. LONDON: Burley House, Theobalds Road, W.C.1.



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3 boiler units each producing 180,000 lbs/hr. at 615 p.s.i. 750°F

INTERNATIONAL COMBUSTION build boilers to suit the individual steam raising requirements of every industry. Whatever the problem, IC steam generating equipment ensures the best use of fuel resources.

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Four Powermaster oil-fired automatic boilers provide all the necessary heating for the new *Daily Mirror* building in London. Fully automatic in operation, completely smokefree, taking up to 50% less space than conventional installations of similar capacity and with a guaranteed efficiency of 83%, Powermasters can be installed *and working* within hours of delivery. Capacity from 500-20,700 lbs. steam per hour. Gas or oil fired.

GWB *Powermaster* AUTOMATIC PACKAGED BOILERS

G.W.B. FURNACES LIMITED, Boiler Division, P.O. Box 4, Dibdale Works, Dudley, Worcs · Telephone: Dudley 55455 (9 lines)

Associated with Gibbons Bros. Ltd. and Wild-Barfield Electric Furnaces Ltd.

GWB.248

Trade Mark

have made their mark!

With this new mark, the Buell organisation emphasises the name under which we have continuously operated in the United Kingdom and overseas since we were established in the United Kingdom in 1927. Buell was first formed to develop Patents relating to equipment for the preparation and burning of pulverized coal, but shortly after formation acquired the patent rights for "Van Tongeren" Dust Collection Equipment and "Büttner" Dryers. As a result of our own extensive experience, supported by the continued co-operation of these associations, the name of BUELL has become the symbol of a first-class engineering service in the solution of Industrial Drying and Dust Collecting problems. In 1954 as Buell (1952) Limited, we became a subsidiary of Edgar Allen & Co. Limited, Sheffield, and recently our name has been shortened to Buell Limited.

In the field of separation and collection of dust we offer complete equipment with the Buell High Efficiency Cyclones fabricated in various types of construction to meet the particular conditions dictated by the requirements of many industries. Buell Drying Plants are well known for their application to the drying of a wide range of materials. It is our policy to make a special study of the various problems involved before selecting the design of Buell Dryer to suit the individual case.

Under our new style "Buell Limited", we continue to offer the same high standard of service in the design, manufacture and erection of Buell Industrial Drying and Buell Dust Collecting Equipment based on extensive experience with the hundreds of plants now operating to our credit in the United Kingdom and overseas.

BUELL-VAN TONGEREN DUST SEPARATORS

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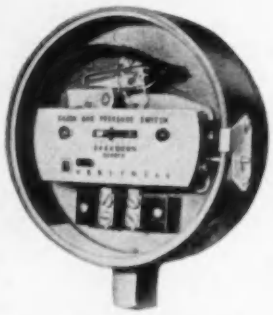
designed for heavy duty

Honeywell Gas Pressure Switches do a tough job well!



pressures ½" wg to 10 psi
C437A for low pressure cutout
C437B for high pressure cutout
C637A SPDT switching action

These new pressure switches are specially designed for industrial use . . . specially made to withstand heavy duty in corrosive atmospheres . . . specially valuable as a simple means to precise automatic control of hazardous and non-hazardous gases. They can be used as safety cut-off switches, pressure controllers, differential pressure controllers and in liquid level applications. To every application they bring enduring Honeywell qualities — completely safe operation, robust construction, clear view of mercury switch and scales, ease of installation and maintenance.

C437A, B and C447A, B convertible by user to automatic lock-out to prevent pre-cycling. All switches incorporate a seal-off diaphragm to prevent gas entering the switch chamber should the main diaphragm be damaged, and a bleed connection to carry the gas away.

pressures 5 to 100 psi
C447A for low pressure cutout
C447B for high pressure cutout
C647A for SPDT switching

Also available for pressures 2-20" water, C645A and C645B, low pressure two-position switches incorporate the seal-off diaphragm. C645B can be supplied with automatic lock-out.

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Please send items ticked:

C437A, B; C637 C447A, B; C647	Specification Sheet S1011-1A	☐
C645A, B	Instruction Sheet 95-1502	☐

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'Alfloc' Service Contract ensures against breakdowns caused by faulty feed-water

Boiler breakdowns and unscheduled repairs mean loss of production, loss of money, worry for everyone. Many of these can be laid at the door of faulty feed-water—but there's one way to ensure that they won't be. By taking out an 'Alfloc' Service Contract you unload your feed-water problems, at the stroke of a pen, on to experts with the whole of I.C.I.'s technical resources behind them. Regular checks, regular supervision, regular supply of the right chemicals banish scale, corrosion and carry-over and provide long-term confidence in boiler plant.

How the 'ALFLOC' SERVICE CONTRACT works

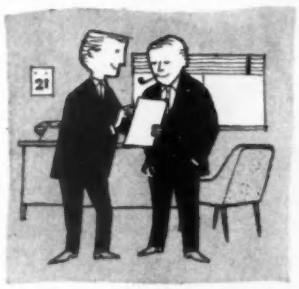
'Alfloc' sends a qualified, experienced water-treatment specialist to make a thorough analysis of your boiler plant feed-water and operating conditions.

Call in an 'Alfloc' specialist

Waters vary so much in composition, behaviour and manner of use that there is no universal answer to your problems. To be certain our methods can produce a solution to your problems, we must know something about your feed-water and plant. This is why we want you to ask an 'Alfloc' specialist to visit you. Take the first step towards an 'Alfloc' Service Contract now—fill in the coupon opposite and post it to us.

The 'Alfloc' Water Treatment Service

The 'Alfloc' Service Contract was originally produced to provide the technical assistance so essential to the stationary boiler plant of small or medium capacity where the employment of specialist resident staff would be uneconomic. 'Alfloc' can also help on many problems arising from other uses of water—process and cooling water treatment, treatment of municipal supplies, locomotive feed-water treatment and treatment of ships' boilers. In such cases a Service Contract may not always be suggested as qualified staff may be available to give technical supervision, or the technical supervision required may be less.



On the basis of this visit the 'Alfloc' representative makes recommendations for feed-water treatment and draws up a Service Contract to suit your needs.

Under the Service Contract all the 'Alfloc' treatment chemicals you need are supplied for an annual fee; a qualified representative calls a stated number of times each year to carry out tests on your plant and advise your engineers; and, if necessary, a test kit and feeding equipment are supplied on loan.

In return, you undertake to make simple daily tests on the boiler-water, and to use the results to adjust treatment to meet changes in day-to-day conditions.

Please arrange for an 'Alfloc' specialist to call

NAME_____

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AL.34

ICI

Imperial Chemical Industries Limited,
'Alfloc' Water Treatment Service,
4, Cromwell Place, South Kensington,
London, S.W.7.

a pointer to the future

The photograph shows the Holmes-Elex Electrical Precipitator which is installed after one of the pulverised fuel fired boilers at the Elland Power Station of the Central Electricity Generating Board. This is but one of many recently commissioned installations all of which are playing a vital part in the fight against atmospheric pollution.

For those dust collection and control problems where electrical precipitation is not the ideal technical or economic solution we are in a position to put forward many other types of plant including: Bag Filters, Wet Washers, Multi-Cell Cyclone Dust Collectors and Cyclone Dust Collectors.

a pointer to clean air

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Detailed technical brochures on our various types of dust collection and control plant are available and can be had on request.

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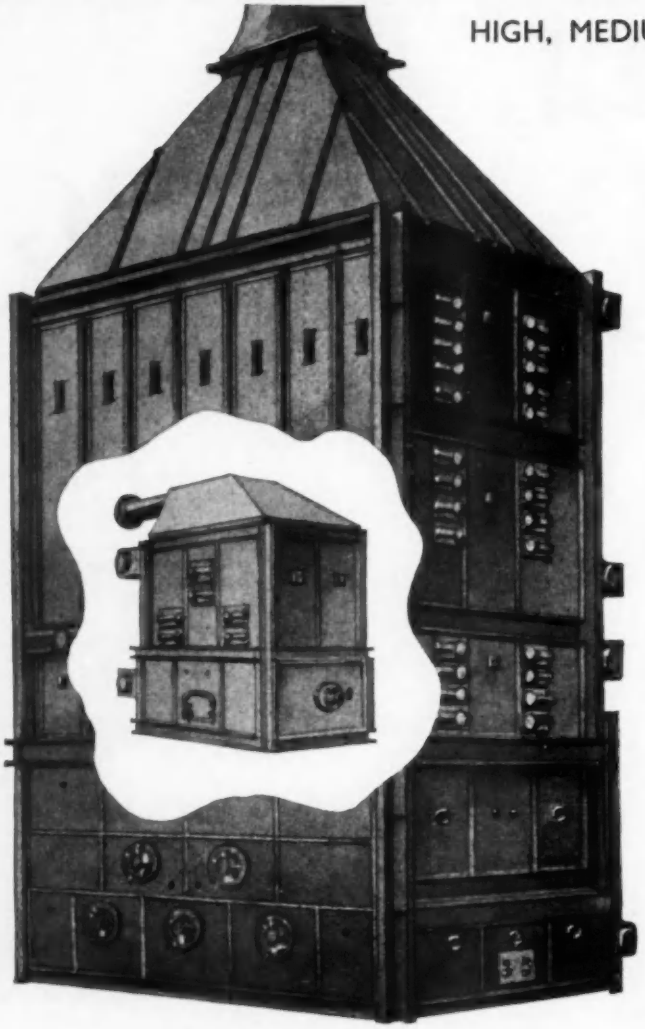
LA MONT HOT WATER BOILERS

HIGH, MEDIUM and LOW PRESSURES



LA MONT Hot Water Boilers are installed for a wide range of capacities and conditions. Illustration shows comparative size of oil-fired boiler for capacity of 70,000,000 Btu./Hr. with 2,000,000 Btu. boiler inset to the same scale.

LA MONT Hot Water Boilers are the most efficient, flexible and compact units available for industrial heating and district heating requirements.

Suitable for coal, oil, creosote pitch or gas firing and for utilising the waste heat in flue gases from all kinds of industrial processes.

LA MONT STEAM GENERATOR LIMITED

HEATHER PARK DRIVE, WEMBLEY, MIDDX.

Telephone: WEMBLEY 8821

Made to Measure

WALLSEND SELF-PROPORTIONING LOW AIR PRESSURE BURNER

- . . specially designed so that the fuel output and air/oil ratios are under complete control.
- . . provides fingertip, single lever control for accurate and efficient regulation.
- . . automatically ensures a correct mixture of air and oil over a wide range irrespective of the type of fuel in use.
- . . has a turn down range of approximately 5 : 1 which can be achieved with a stable flame, efficient combustion and a high CO_2 content.
- . . leads the way to automatic or remote control of single and multi-burner installations.
- . . incorporates the well known Wallsend features of robustness, long service with little maintenance, and flexibility.

The Burner shown has a maximum output of 12 gallons per hour and requires atomising air at 20" (51 cm) w.g. to 30" (76 cm) w.g. with oil at not less than 5 lbs per sq. in. (0.35 kgs. per sq. cm.) or equivalent head.

For more efficient

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THE WALLSEND SLIPWAY & ENGINEERING COMPANY LIMITED

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FOR DISTRICT HEATING and INDUSTRIAL PLANT REQUIREMENTS

LA MONT HOT WATER BOILERS

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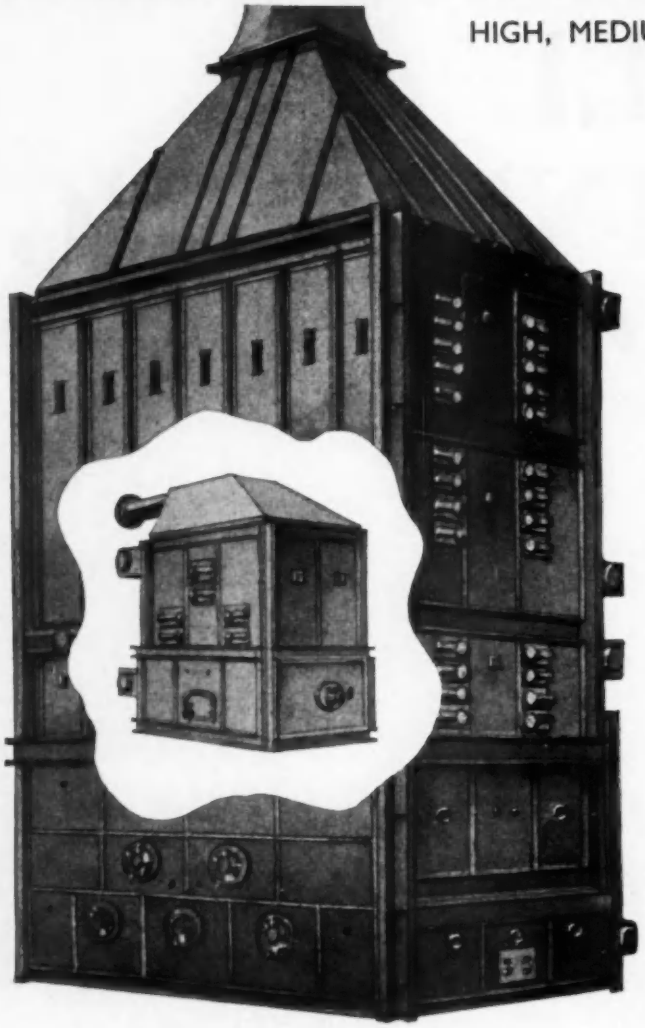

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Suitable for coal, oil, creosote pitch or gas firing and for utilising the waste heat in flue gases from all kinds of industrial processes.

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When Replacing Obsolete STEAM BOILERS

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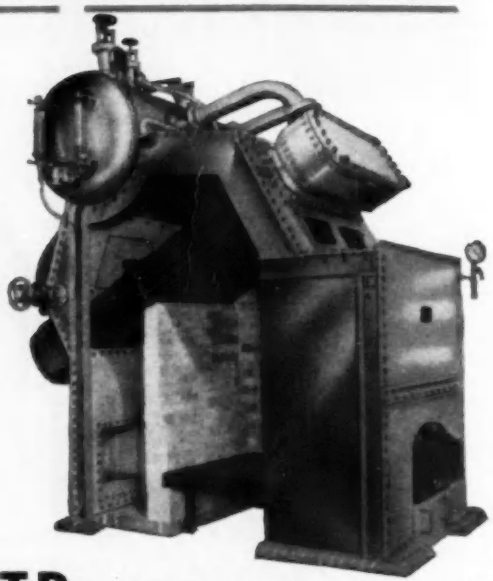
FRASER WATER-TUBE BOILER

Unsurpassed for efficiency and versatility, the Fraser Boiler has the distinctive merit that it incorporates a large brick-lined smoke consuming combustion chamber, thus complying with the requirements of the Clean Air Act.



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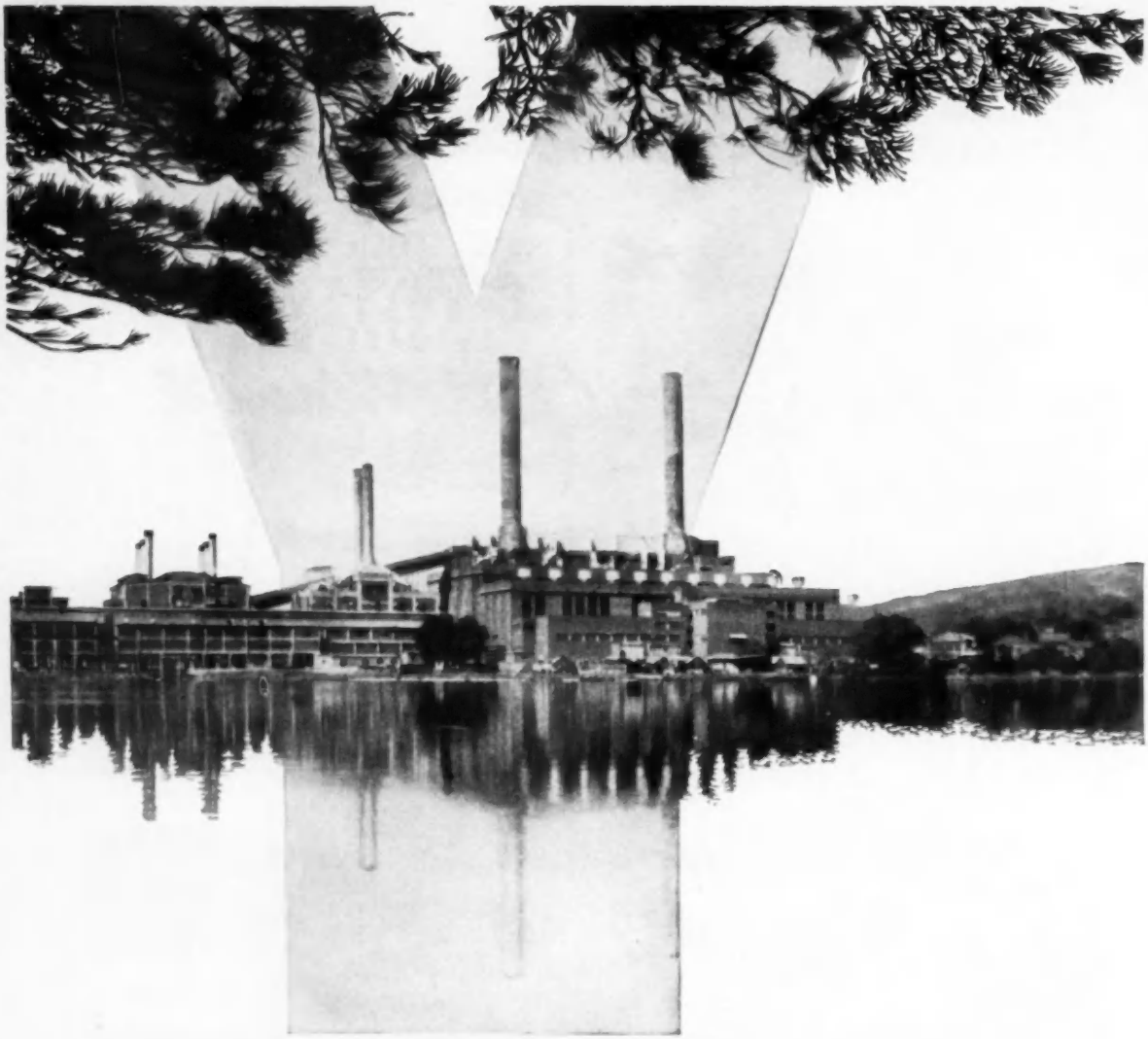

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18 YARROW BOILERS
installed at Pretoria 'A & B'
Power Stations

NOW

2-550,000 lb per hour
950 lb per sq. inch

915°F pulverised fuel fired
YARROW boilers ordered by
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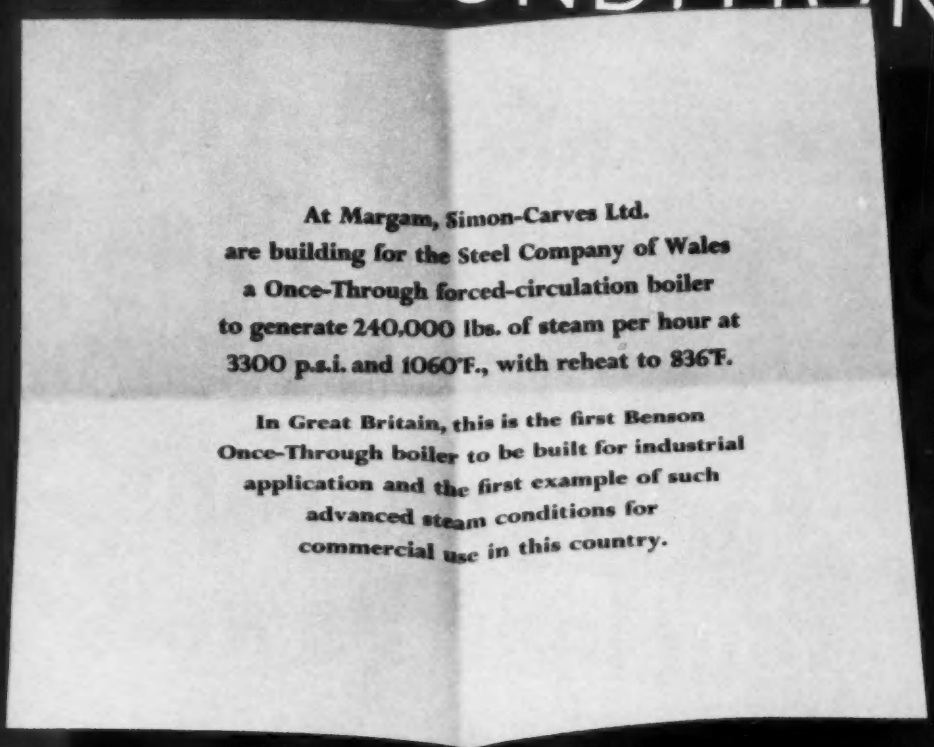
ADVANCED STEAM CONDITIONS



At Margam, Simon-Carves Ltd. are building for the Steel Company of Wales a Once-Through forced-circulation boiler to generate 240,000 lbs. of steam per hour at 3300 p.s.i. and 1060°F., with reheat to 836°F.

In Great Britain, this is the first Benson Once-Through boiler to be built for industrial application and the first example of such advanced steam conditions for commercial use in this country.

Howden are supplying two forced-draught fans, two induced-draught fans and one recirculating fan

HOWDEN

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VOKES GENSPRING have been awarded contracts for the supply of pipe suspension equipment for all current Nuclear Power Stations

Vokes Genspring constant support hangers—capable of supporting loads up to 97,800 lb. and travels up to 12"—have been specified by all five members of the Nuclear Consortia for each of the first five Nuclear Power Stations. Gensprings have already been installed at Calder Hall A & B and Chapel Cross A & B where their success in handling the movement of piping caused by temperature changes is rapidly making them an automatic choice for pipework support in the construction of Nuclear Power Stations.

BERKELEY (A.E.I.-John Thompson Nuclear Energy Co. Ltd.)

BRADWELL (The Nuclear Power Plant Company Ltd.)

HUNTERSTON (G.E.C.-Simon Carves Group)

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Vokes Genspring SUSPENSION SYSTEMS

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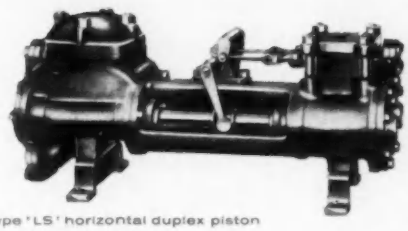
A member of the VOKES Group.

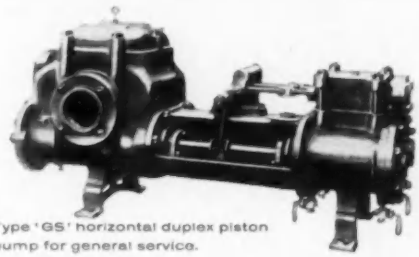
VG/48A

STEAM DRIVEN PUMPS *for* WATER

AND GENERAL SERVICE



Type 'LS' horizontal duplex piston pump for light service.

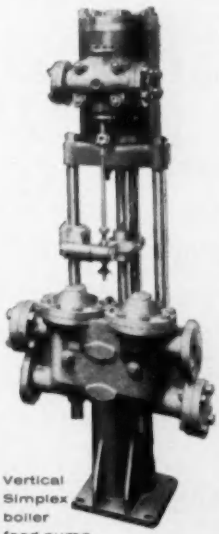


Type 'GS' horizontal duplex piston pump for general service.

Worthington-Simpson horizontal and vertical steam pumps ensure maximum operating efficiency and the standard range of these versatile pumps caters for many industrial applications at pressures up to 250 p.s.i., in the case of horizontal duplex models, and 300 p.s.i. for vertical simplex models.

Steam pumps are suitable for a wide range of land and marine applications. They are ideal for heavy duties, handling viscous liquids for instance. 'Close clearance' steam pumps—of which there is a large range—are ideal for pumping highly volatile liquids.

Horizontal Simplex direct acting steam pump.



Vertical Simplex boiler feed pump.

Worthington-Simpson Ltd.

PUMPS · COMPRESSORS · HEAT EXCHANGE EQUIPMENT

NEWARK NOTTS

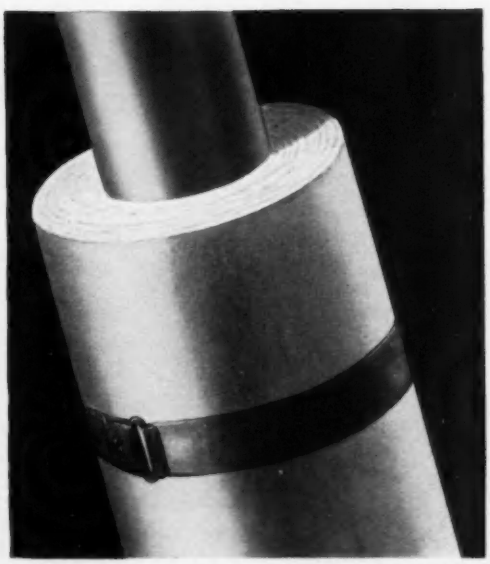
P.4233

"I was Cool, Man, Cool!"

'Steamy' Pipe reminisces

"It's my job to carry steam — and to keep it at s-s-s-steam heat. But I was falling down on the job — as flat as an old-fashioned waltz at a Rock 'n Roll Rally. I was losing heat. Wasting fuel. Throwing away money. If I hadn't been so round, you could have called me a square.

What a difference when they fitted me from top to toe in Fibreglass Rigid Sections! Man, these sections are really something! They're light; they're trim; they go on easily and stay on permanently. Since they came along, I've been the savingest pipe in the business; *and* I keep the steam just as it should be — piping hot!"



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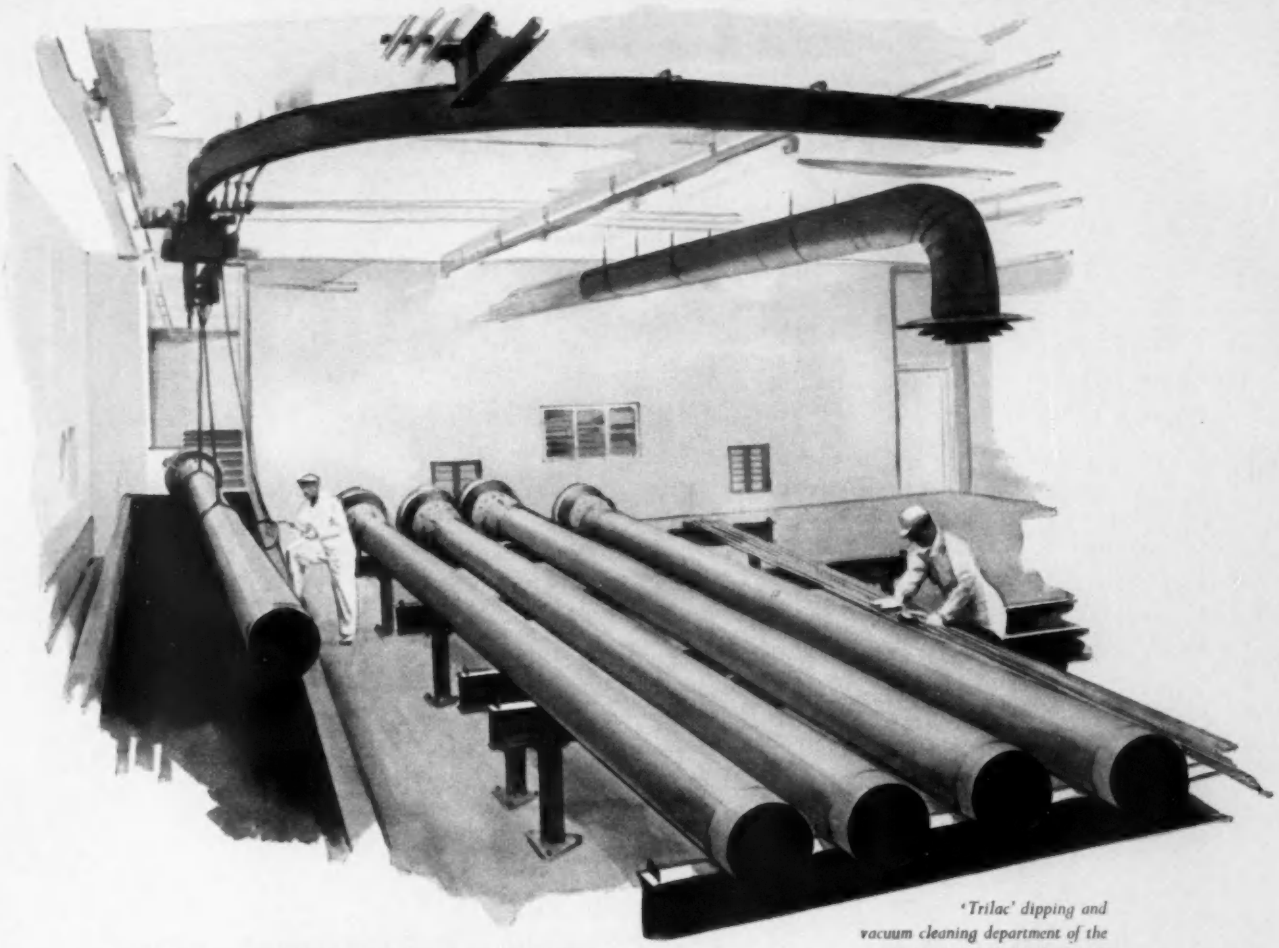
"Rigid Sections are the most"

'Steamy' Pipe proclaims

FIBREGLASS LIMITED, ST. HELENS, LANCASHIRE · ST. HELENS 4224



'Trilac' dipping and vacuum cleaning department of the 'CLEAN CONDITIONS' PLANT

S & L PIPEWORK FOR BRITAIN'S NUCLEAR POWER STATIONS

It is becoming general for many components for nuclear plants and other forms of construction to be assembled under entirely dust free conditions.

To meet the requirements of the nuclear age S & L have constructed a special 'clean conditions' plant at their Tollcross Works in Scotland. This new plant is probably the largest and best equipped in industry and comprises many important features, including fully filtered and heated air, a large assembly area, together with cleaning and protection facilities.

An example of the work assembled in this shop is the control rod standpipes for Hunterston nuclear power station. The standpipes shown in the illustrations accommodate boron rods and house the small bore burst slug detection piping.

S & L will be pleased to discuss any problems associated with clean conditioning of industrial components.

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Glasgow · Birmingham · London

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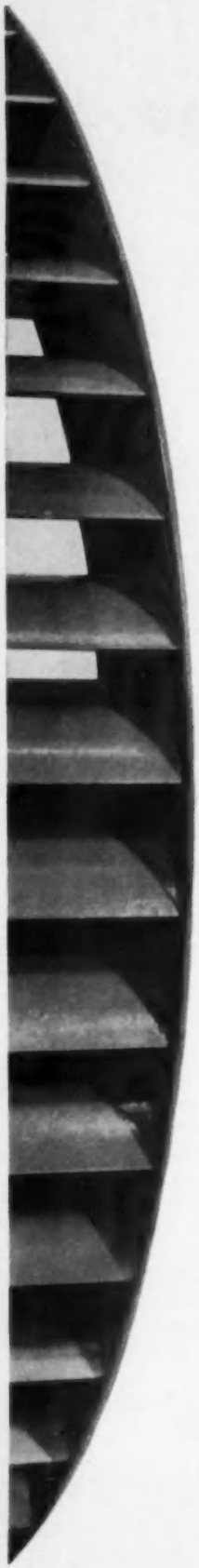


formula for leadership

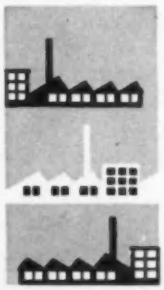
Experience Founded originally in 1823 the Company has had the widest experience in the design and manufacture of all types of equipment for the handling of air and other gases. Blowers, exhausters, heaters, filters, dust and fume removal equipment, and of course, fans of all types, fall within this wide scope. Fans of every size and for every purpose, from Coal Mines to Aircraft Carriers, have been designed, manufactured and tested by Keith Blackman and installed in all parts of the world—experience unparalleled in the field.

Range The Keith Blackman range covers virtually every type of fan and blower in all sizes—axial types from 5 inch to 100 inch diameter, centrifugal types ranging from 1¼ inch to 180 inch, and propeller fans from 6 inch to 72 inch diameter. Many are designed for special applications and in special materials including pvc. Other equipment is made for heating, cooling, washing, dust and fume extraction, filtration and air conditioning. *Five thousand fans of varying types are kept continuously in stock for quick delivery.*

Research Keith Blackman's lead in design is maintained by five separate research departments. Specialised facilities are available at Tottenham for the development and testing of axial fans, centrifugal fans and filtration equipment, while a metallurgical laboratory controls the quality of materials founded at Arbroath. Tottenham also possesses one of the most advanced acoustics laboratories in the world for the investigation of sound levels in all types of fan engineering equipment.
In addition, the company's generating station, as well as supplying power to the factory, is designed to produce a wide range of A.C. and D.C. supplies for the test beds.

Keith Blackman Ltd
(incorporating Blackman Export Co. Ltd.)
MILL MEAD ROAD, LONDON N.17 TOTTENHAM 4522

Leaders in the Fan Industry



Resources The company's three factories cover an area of 17¾ acres, and employ over 1,800 people. The main Tottenham works produces small and medium units and includes drawing offices, test facilities and machine shops, as well as the sales and administration offices.
The Arbroath works deals with the production of the larger fans. Its iron and non-ferrous foundry plant supplies the whole of the company's casting needs.
The Edmonton Factory concentrates on light sheet metal and plate work and the fabrication of steel structures.
Virtually all components, including fan motors and bearing housings, are thus designed and manufactured within the organisation—a unique combination of resources.

Service Through the years the company has built up an enviable reputation for service at all stages. Sales representatives are all fully trained technical men capable of giving 'on the spot' advice on routine applications or special problems. The sales organisation operates from branches throughout the country backed by a staff of qualified sales engineers at Head Office.
Despatch of stock items, of which 5,000 units are kept continuously available, is possible in as little as four days. The Company has its own road transport fleet and direct rail connections from the main factory.

TA2545/1040

STEIN Refractories

REFRACTORY CONCRETES

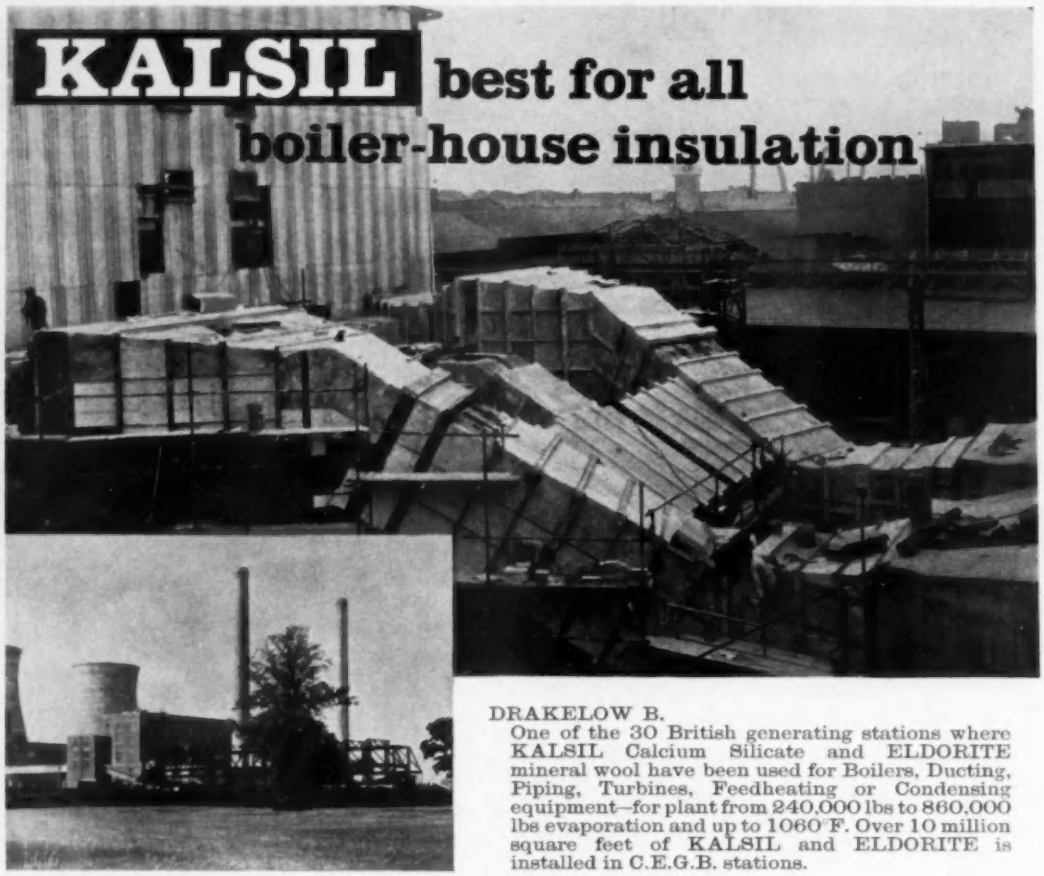
are finding increasing applications in all manner of furnace constructions. Our illustration is of a soaking pit cover where a very useful life is regularly obtained using Stein Refractory Concrete. We can offer a range of Refractory Concretes for use up to 1800°C—See technical data below:—

	How supplied	Refracteri-ness	Type of Set	Thermal Hardening Temperature	Maximum Temperature of Use	Lbs./Cub. Ft.
Stein Refractory Concrete No. 13	Dry	1420°C	Hydraulic	1200°C	1350°C	120
No. 14	Dry	1500°C	Hydraulic	1200°C	1450°C	120
No. 16	Dry	+ 1750°C	Hydraulic	1200°C	1600°C	160
No. 17	Dry	+ 1750°C	Hydraulic	1200°C	1700°C	160
No. 18	Dry	+ 1750°C	Hydraulic	1200°C	1800°C	160
Stein Chrome Concrete	Dry	+ 1750°C	Hydraulic	1200°C	1500°C	180

JOHN G. STEIN & CO. LTD. Bonnybridge, Scotland

TEL: BANKNOCK 255 (4 LINES)

KALSIL best for all boiler-house insulation



DRAKELOW B.
One of the 30 British generating stations where KALSIL Calcium Silicate and ELDORITE mineral wool have been used for Boilers, Ducting, Piping, Turbines, Feedheating or Condensing equipment—for plant from 240,000 lbs to 860,000 lbs evaporation and up to 1060°F. Over 10 million square feet of KALSIL and ELDORITE is installed in C.E.G.B. stations.

KALSIL offers these advantages

- Low K Factor at temperatures up to 1400°F.
- Thermal decomposition rate virtually nil.
- 100% mineral: contains no organic binder to burn or carbonise.
- Application is made direct—so cutting out extra time and cost of any intermediate H.T. insulation.
- High compressive and flexural strength.
- Easy to handle, easy to install.

Manufacturers and Contractors

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Snapper-up of unconsidered trifles

In a competitive world it is the unconsidered trifles of industrial production that can make the difference between profit and loss.

Not that the benefits to be got from intelligent recovery of process heat are exactly *trifles*. They can be surprisingly substantial and widespread.

For instance. Using " waste " heat to pre-heat incoming material in a process effectively increases the heating surface of the process plant. This can mean less demand on the boilers, the ironing out of peak loads, and a better quality production run.

Often, if vapours and process liquors are corrosive or otherwise unsatisfactory for direct recovery, it is argued that the heat in them cannot be recovered.

This is unprofitable thinking when the right choice of heat exchanger may make the operation feasible and economic. And when our associate company, Heat Transfer Limited, can help you make that right choice.

Our point is that getting your own back from " waste " heat can be a *positive* production factor, and not just the negative one of not wasting fuel.

Our Information Sheets " Condensate Return " and " Flash Steam Recovery " are just two examples of this kind of profitable thinking. They talk horse sense in engineers' language.

SPIRAX - SARCO

Please post . . . free copies of " Condensate Return " and " Flash Steam Recovery."

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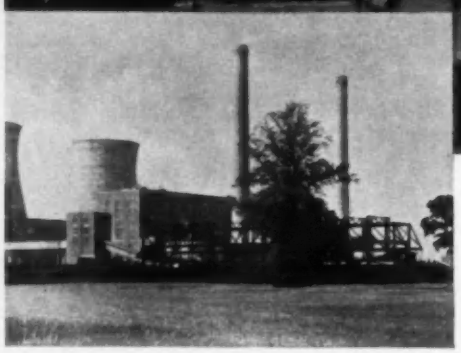
Spirax-Sarco Ltd. Cheltenham Glos. Phone: Cheltenham 5173 Spirax Telex Cheltenham London: 28 Victoria Street SW1 Abbey 6101-3832

D

KALSIL best for all boiler-house insulation



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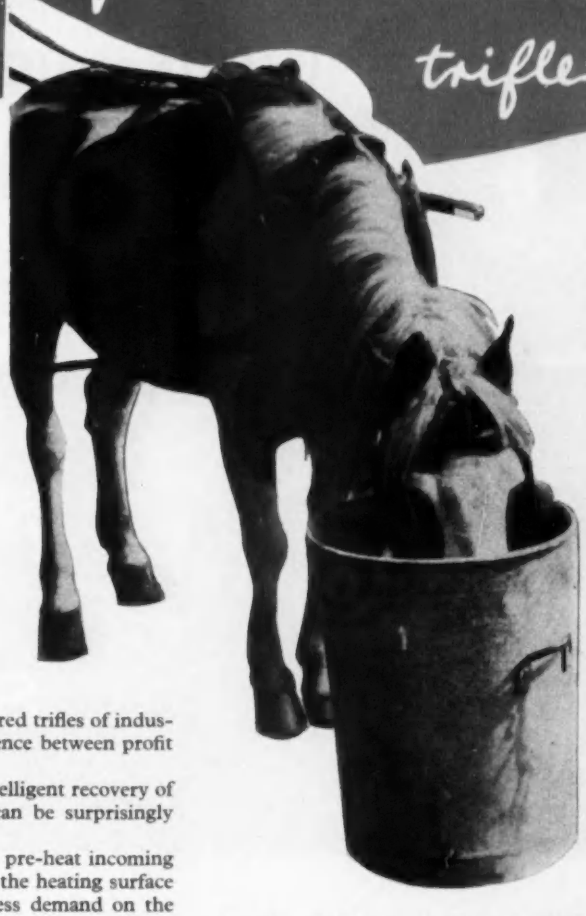

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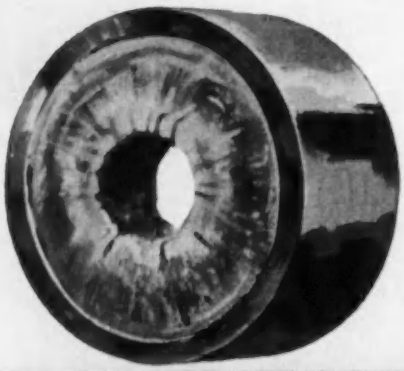
D

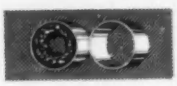


Don't let scale get a stranglehold

Shift it with Sheffite!

When scale threatens to choke the efficiency out of boilers, pipes, or any industrial plant, the safe, swift and simple way back to normal is to use '*Sheffite*' descaling fluid. Sheffite goes to work *fast* on all forms of scale but a powerful inhibitor prevents it from damaging the system itself. It's easy to use, too—it is simply pumped through, using existing connections and outlets. Your own operatives can do the job, in which case you may hire all the pumps and hoses you will need from General Descaling. Or you can call in a fully equipped General Descaling team.

Remember—scale is slow death to thermal efficiency and fuel economy. Don't wait until you've a costly dismantling job on your hands. Write now for fully descriptive literature, and if possible enclose a sample of scale.



SHEFFITE descaling fluid is a product of General Descaling Co. Ltd., and owes its development to their unrivalled practical experience in removing scale and other obstructions from pipelines the world over.

SHEFFITE shifts scale

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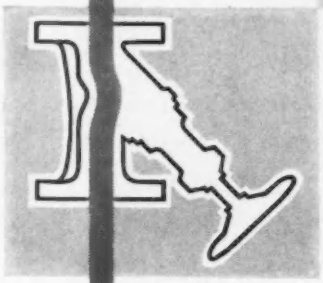
D2

In every way a winner from Hattersley



A valve combining streamlined flow with positive shut off. For HIGH PRESSURE HOT WATER HEATING up to 250 p.s.i.

Notable features of design.

1. Cast gun metal body and cover for strength and corrosion resistance.
2. Heavy construction with strengthening ribs scientifically designed to distribute stresses away from the shut-off zone.
3. 'Y' design ensures minimum flow resistance.
4. Renewable disk and seat are made from different nickel alloys for long trouble-free life.
5. Aluminium Bronze spindle with provision for repacking gland under pressure if necessary.
6. Extra wide and deep gland chamber packed with special braided and graphited asbestos block rings.
7. New Design Handwheel for comfortable and effective operation.
8. Available with Double Regulating Device for proportionate control of flow at all settings.
9. **Fig 1200 also suitable as a general purpose Steam Stop Valve.**

There are 3 models of this valve in sizes from ¼ in. to 2 in.
1. Fig 1200 GM 'Y' Type Stop Valve 2. Fig 1200R GM 'Y' Type Regulating Valve
3. Fig 1200 DR GM 'Y' Type Double Regulating Valve.
Please write for your copy of the brochure in which they are fully described and illustrated.

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ESTABLISHED 1897

the name for good valves

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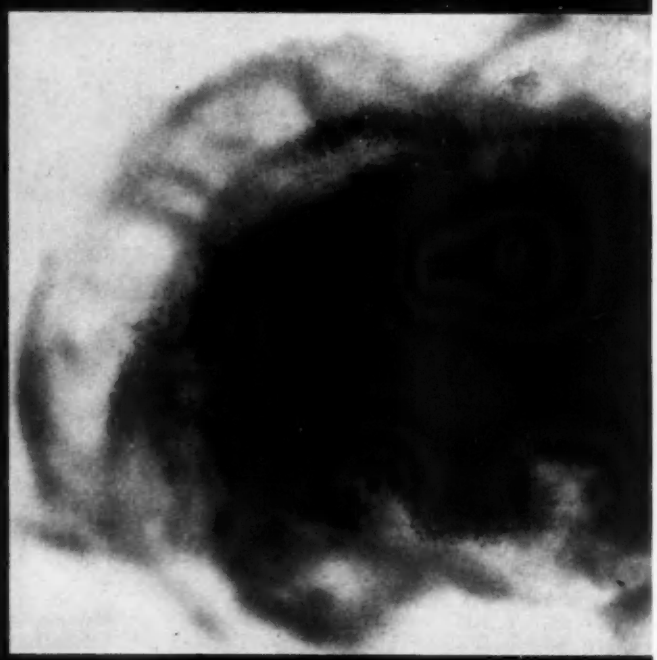
H.4

Crane recently added to their wide range a series of gate, globe and check valves in Forged Steel. These valves are designed for long service in severe working conditions. A varied trim selection makes them applicable to many different services, including chemicals of a corrosive nature, and steam at high pressures and temperatures up to 1,000 degrees F. Crane Forged Steel Valves are made with screwed or socket-welding ends to British and American Standards. Sizes range from ¼" to 2".
In common with all Crane products, these Forged Steel valves are made to extremely high standards and are subjected to careful inspection and individual testing at every stage. They are therefore completely dependable in situations where working conditions are arduous and long life is essential.

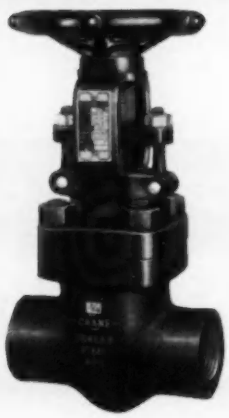
HIGH PRESSURE STEAM IN CHECK



Fuller details of Crane Forged Steel Valves are given in Crane Leaflets, which may be had on application to Dept. 24, Crane Ltd., 15-16 Red Lion Court, Fleet Street, London, E.C.4
Works: Ipswich

Branches: Birmingham, Brentford, Bristol, Glasgow, Leeds, London, Manchester.

the toughness of forged steel valves by CRANE



V33

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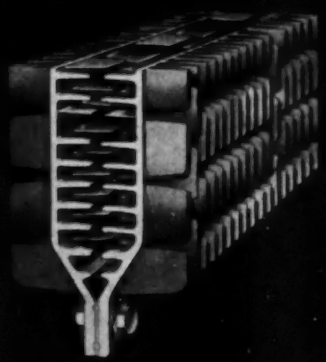

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These are some of the slime-forming organisms which cause loss of efficiency and blockages in industrial cooling water systems by fouling heat-transfer surfaces, filters, pipes, storage basins and cooling towers. Organic growths can be controlled by chlorination, a simple method which increases efficiency and reduces to a minimum the interruption of plant operation. For advice on the application and handling of liquid chlorine and hypochlorites, consult:
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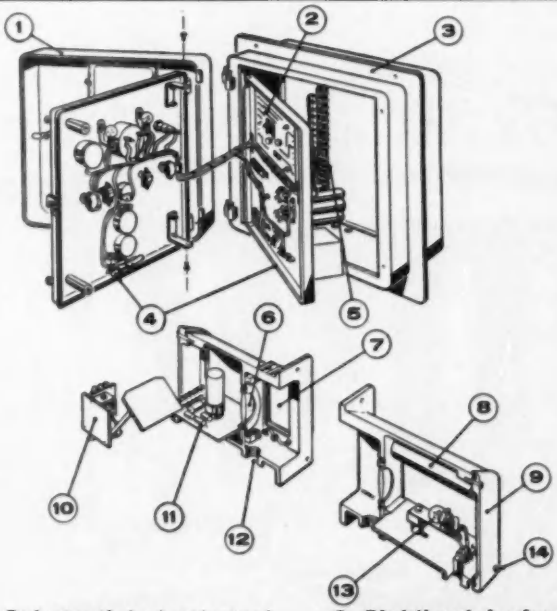
Now—you can ensure* *economic* protection against clean air act infringement—



1. Substantial sheet steel construction.
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3. Optional flange mounting accessory.
4. Hinged leaf construction for ease of access.
5. Accessible external connections.
6. Rigidly mounted lens assemblies.
7. Easy access for lens cleaning.
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9. Solid cast iron construction with sealed covers.
10. Optional remote standardising accessory.
11. Withdrawable printed circuit card carrying photocell.
12. Entry for customer's conduit.
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The Lancashire Dynamo Smoke Alarm protects you by warning when the Clean Air Act smoke limit is exceeded.

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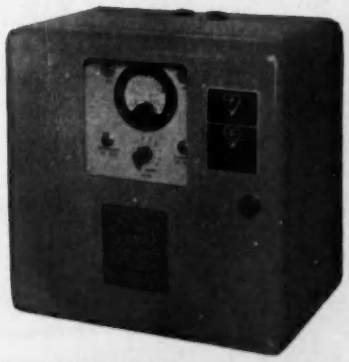
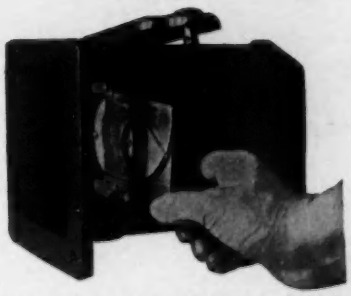


Main unit showing locked away controls and calibration meter.



Calibration check by manual insertion of check slide.

*

This equipment is the first of its kind to carry the British Standards Institution's "Kite Mark", which indicates independent certification of compliance with BS.2740/56 or, plus the appropriate indicating instrument, with BS.2811/57.

In addition — from one source — all necessary installation accessories including chimney and flue fitments, indicators, recorders, alarm bells, horns, multicore cabling — write for full details.

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SP. 16b

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Every FORD

Progressive industry is going

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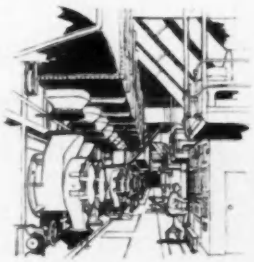
FIVE STAR MOTORING—gleaming, colourful, swift and safe—begins at Dagenham, a giant factory that covers over 550 acres of a once desolate marsh. The judgment and business acumen of the men who have made Ford one of our great key industries is reflected in every operation in the factory, every decision in the boardroom.

In the impressive steam power plant that supplies the entire factory, coal is the chosen fuel. Coal has been chosen because pulverised coal—fired in powder form—*gives accurately controlled heat with the lowest fuel bills.* Coal has the invaluable long-term advantage that it is a home-produced fuel which can supply all the fuel needs of British industry for decades to come.

If your voice is a deciding one in the choice of fuels, remember Ford. Beneath its smokeless chimneys is a wealth of knowledge and applied experience that is an invaluable example of hard thinking and wise decisions. Ford say *coal*. That's five-star wisdom.



Here are some key facts and figures about the Ford main power station

Number of boilers.....4 high-pressure water-tube boilers, with superheaters, airheaters and economisers
Steam pressure.....1,250 lbs. per sq. inch
Steam temperature.....940°F
Feed temperature.....380°F
Continuous maximum rating....1,000,000 lbs. of steam per hour (largest unit 400,000 lbs. per hour)
Method of firing.....Pulverised fuel
Fuel (for steam raising) 207,000 tons of coal a year
(for steel making) 342,000 tons of coal a year

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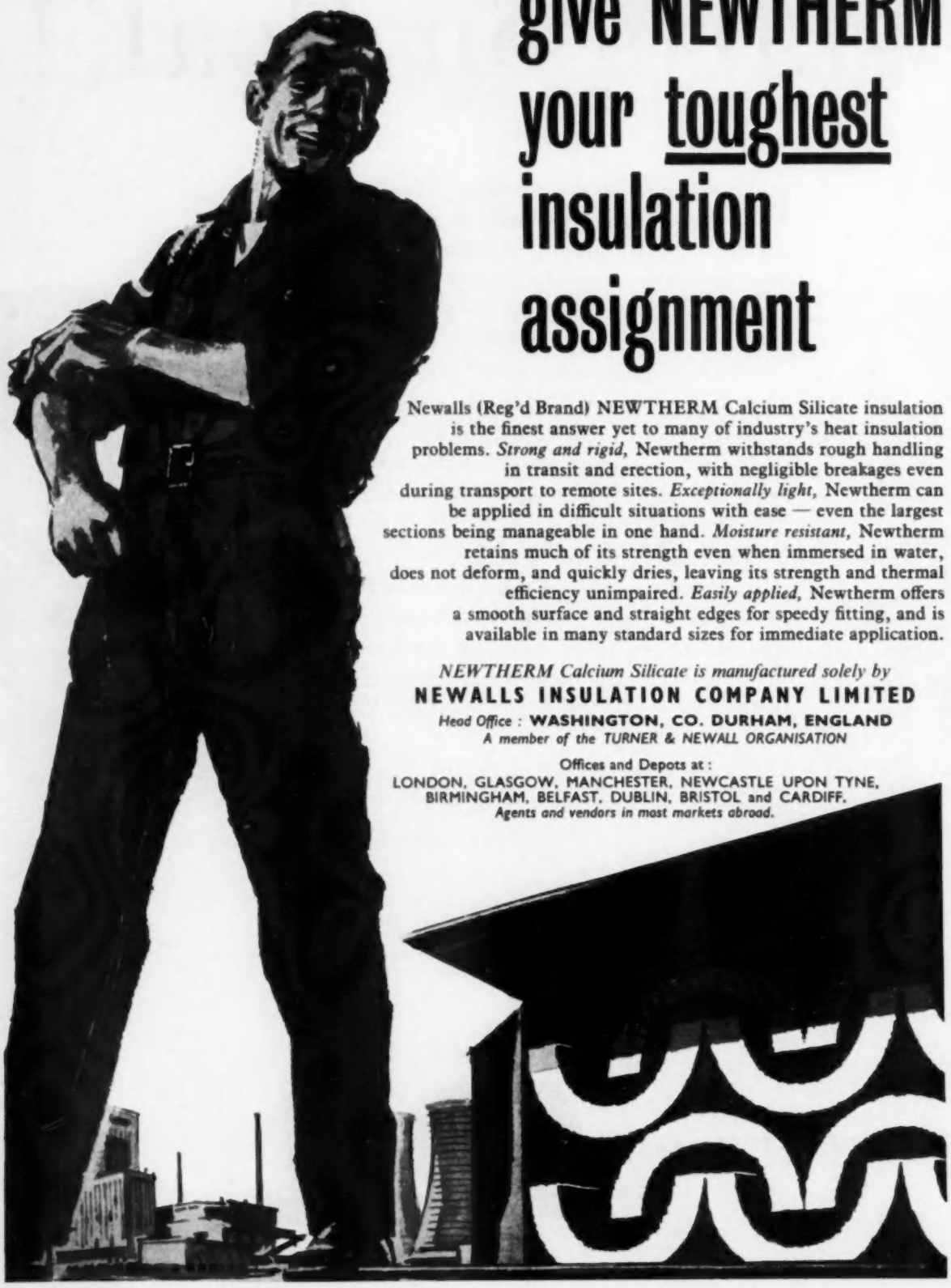
forward on COAL

See the modern mechanical coal-firing equipment on the N.C.B. stand No. 8F at the Fuel Efficiency Exhibition, Olympia, from April 27th to May 6th.



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Newalls (Reg'd Brand) NEWTHERM Calcium Silicate insulation is the finest answer yet to many of industry's heat insulation problems. *Strong and rigid,* Newtherm withstands rough handling in transit and erection, with negligible breakages even during transport to remote sites. *Exceptionally light,* Newtherm can be applied in difficult situations with ease — even the largest sections being manageable in one hand. *Moisture resistant,* Newtherm retains much of its strength even when immersed in water, does not deform, and quickly dries, leaving its strength and thermal efficiency unimpaired. *Easily applied,* Newtherm offers a smooth surface and straight edges for speedy fitting, and is available in many standard sizes for immediate application.

NEWTHERM Calcium Silicate is manufactured solely by

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Head Office : **WASHINGTON, CO. DURHAM, ENGLAND**

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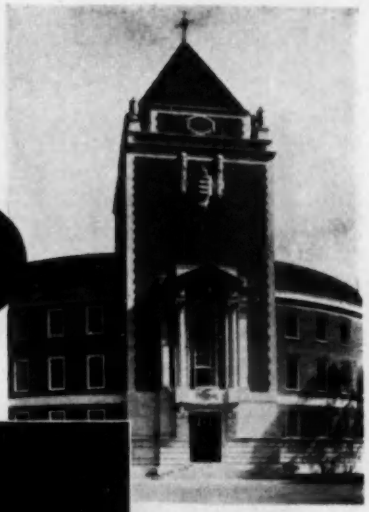

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1350 kW. 11,000 volts.

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Portland Place,
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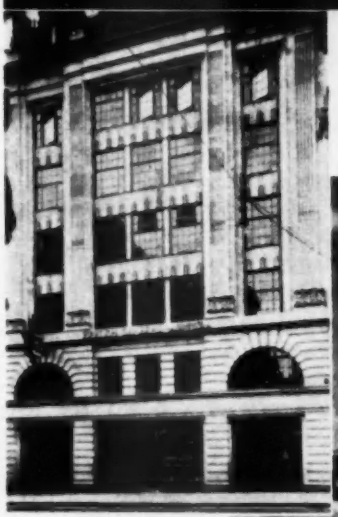
1,000 kW. 11,000 volts.

THE GUILDHALL,
Kingston, Surrey.
600 kW. 3,300 volts.

ST. MARYLEBONE
Town Hall,
London, W.1.
625 kW. 6,600 volts.

SULZER HAVE INSTALLED IN GREAT BRITAIN SINCE 1929 H.T. BOILERS TOTALLING OVER 75,000 K.W.



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12,000 kW. 11,000 volts.
The whole plant designed and installed
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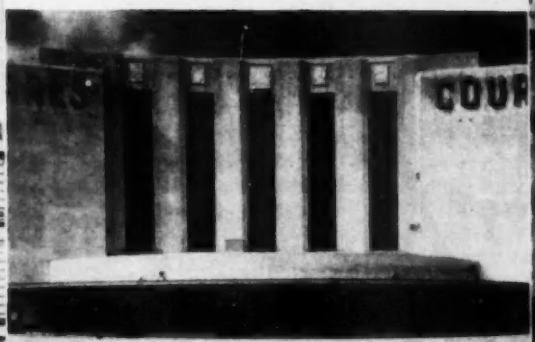

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1,000 kW. 11,000 volts

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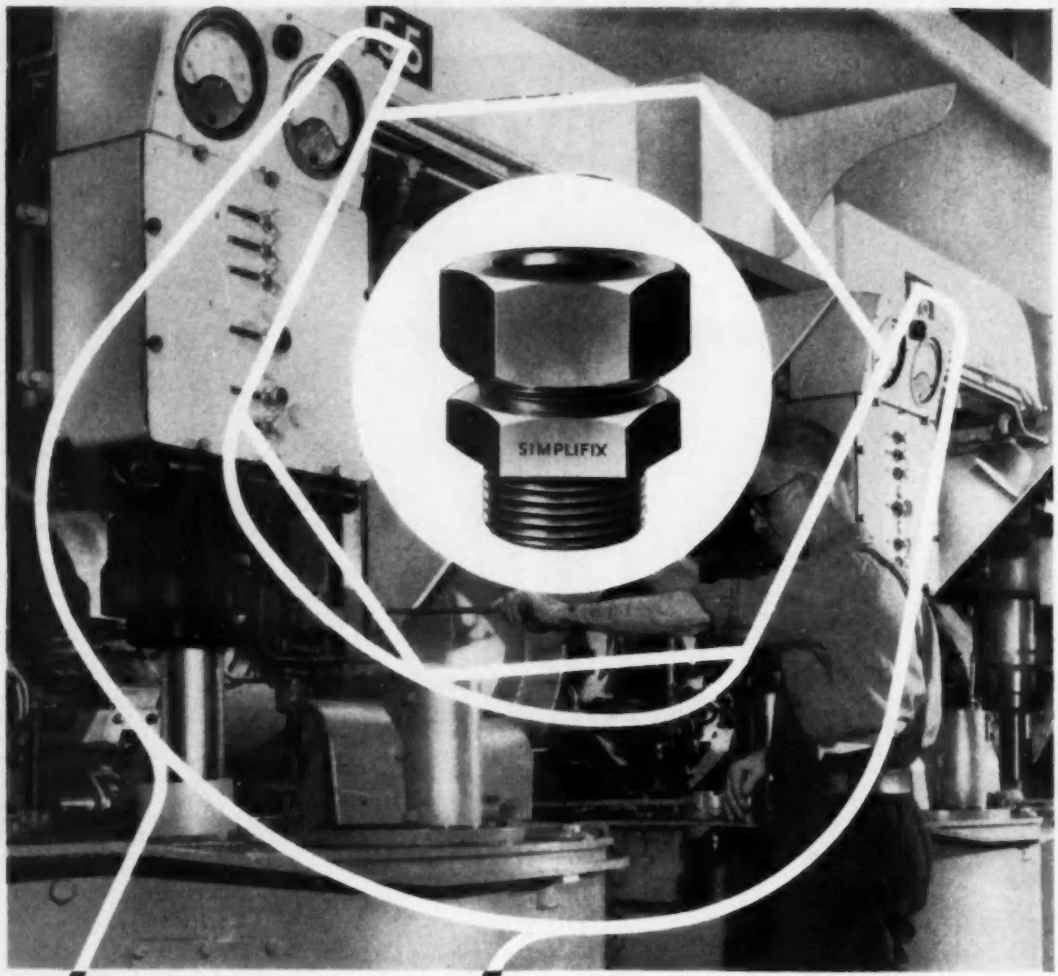

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Simplifix — the sure and simple compression coupling for copper pipe. Perfect joints with almost all kinds of tubing, including those with very thin walls. No work to do on the pipe. Simply tighten the nut — the anti-friction washer prevents pipe twisting. Manufactured since 1930, still the best. Millions in use. Made in sizes to suit tubing from $\frac{1}{8}$" to 2" O.D., in a wide range of interchangeable standard fittings. Non-standard fittings also made to order. Let us send you the Simplifix catalogue.

The illustration shows centrifugal machines at the Plaistow Wharf Sugar Refinery of Tate and Lyle Ltd., where large numbers of Simplifix couplings are used.

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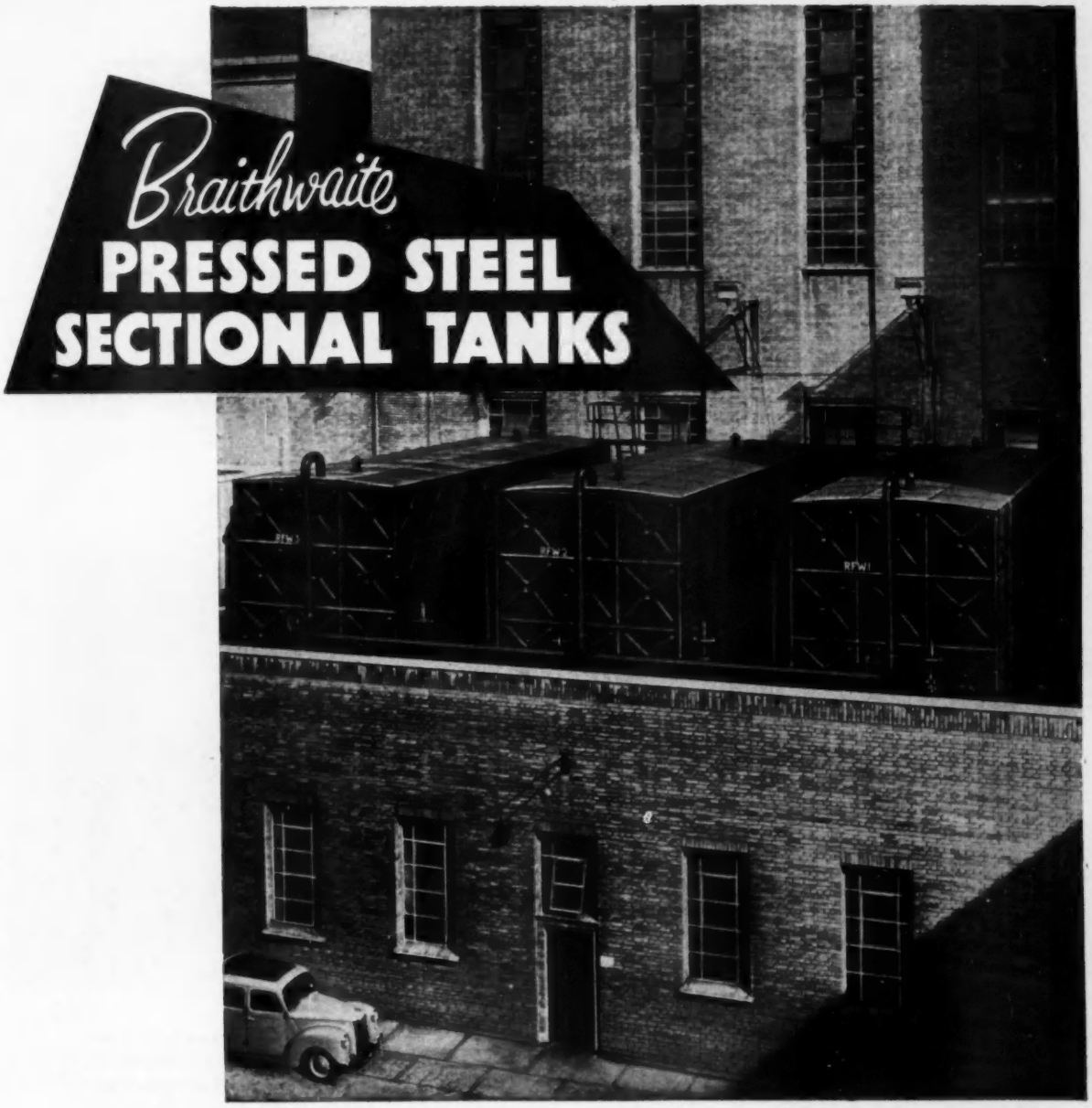

Braithwaite Pressed Steel Tanks with external flanges throughout comply with British Standard 1564: 1949. The sectional method of construction enables tanks with an unlimited range of capacities to be provided. Suitable for the storage of most liquids and viscous substances, they can be economically transported and erected in positions inaccessible to other forms of construction. They can also be increased in size when additional capacity is required. Illustrated brochure will be sent on application.

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BT/27

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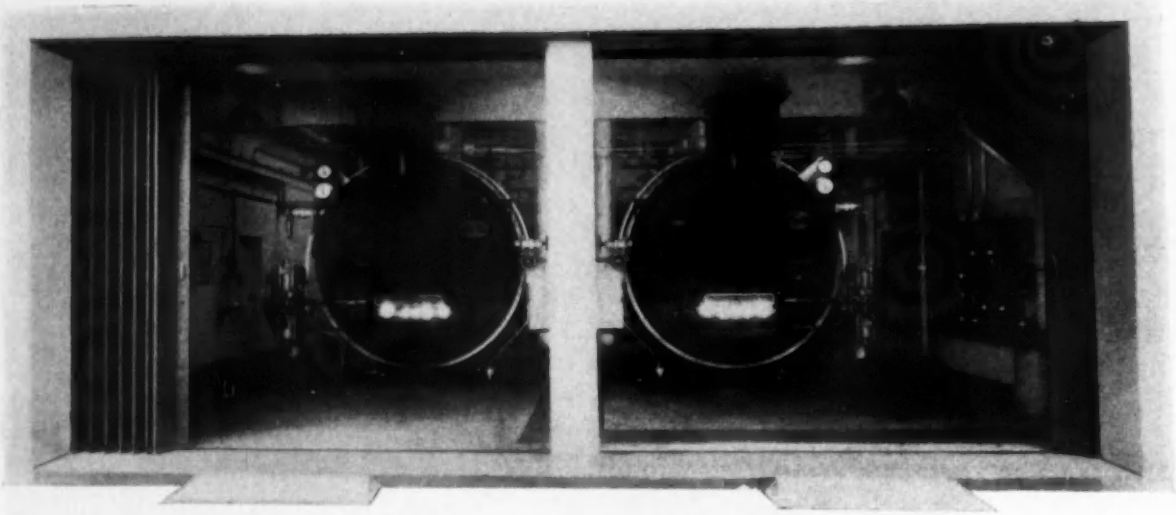
Take a look at the boiler house at Grimethorpe proudly used by the National Coal Board as a showpiece of efficiency! Two Ruston Horizontal 'Thermax' boilers provide steam and hot water for No. 4 Area Workshops. (North Eastern Division.) The N.C.B. with their vast experience, know that the 'Thermax' gives exceptional service. Efficiencies of 80½% and over are usual—*whether fired by coal or any other fuel.* Only *the genuine* 'Thermax' is backed by 25 years of production and application know-how. This Ruston know-how can cut *your* steam raising costs.



* National Coal Board will be pleased to show you their coal-fired 'Thermax' Boiler installation at Grimethorpe. Get in touch with us and we will gladly arrange a visit.

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HORIZONTAL

'THERMAX' BOILERS

Evaporations of up to 17,500 lb per hour

HIGHEST EFFICIENCY FOR ALL TYPES OF FUEL

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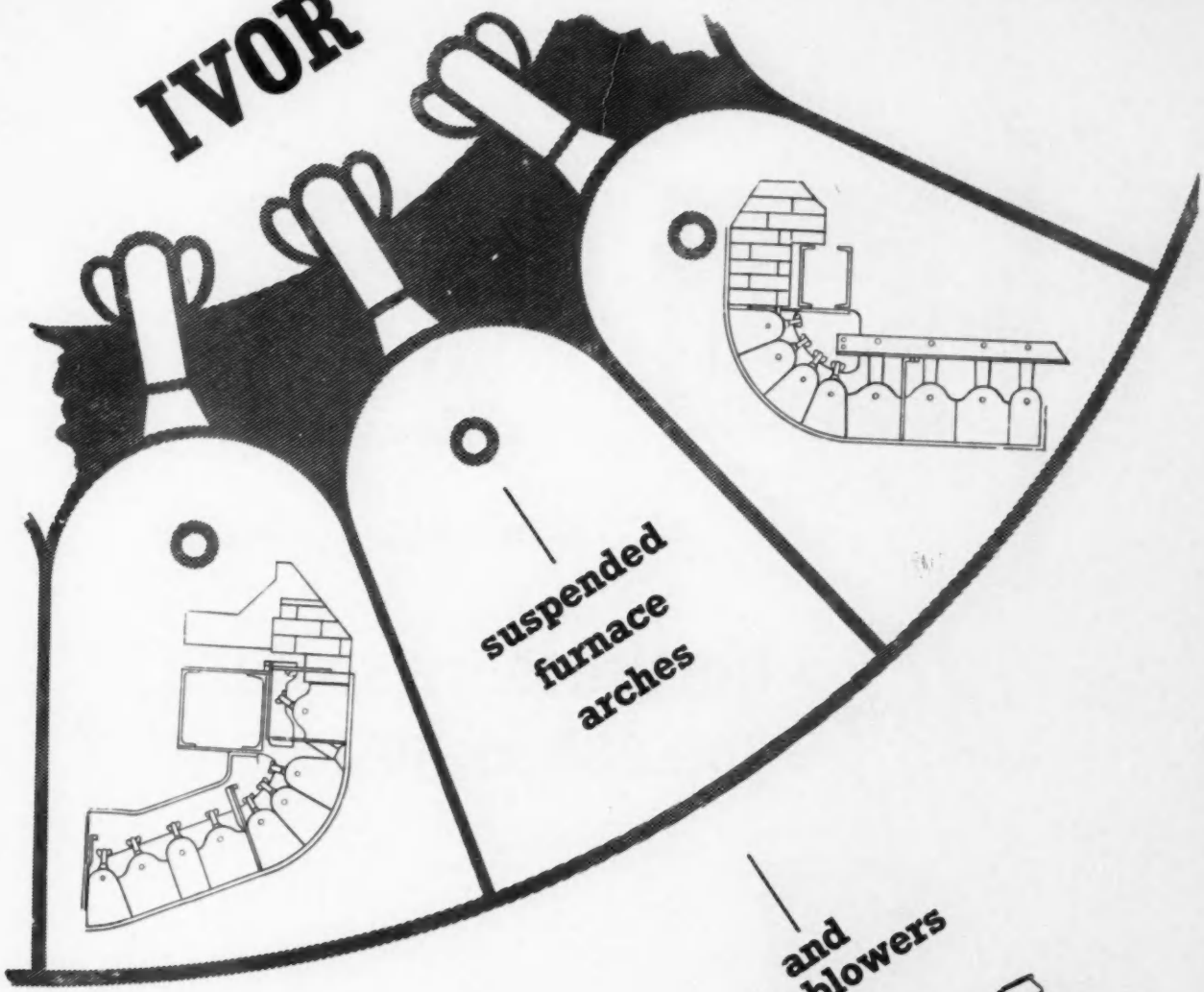
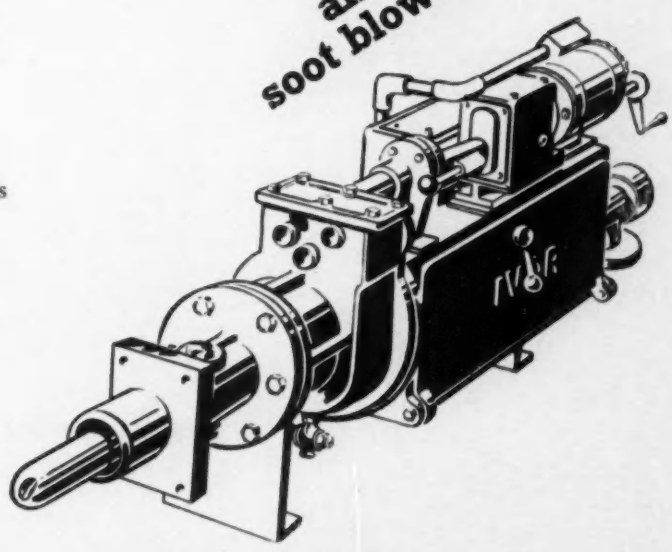


and
soot blowers



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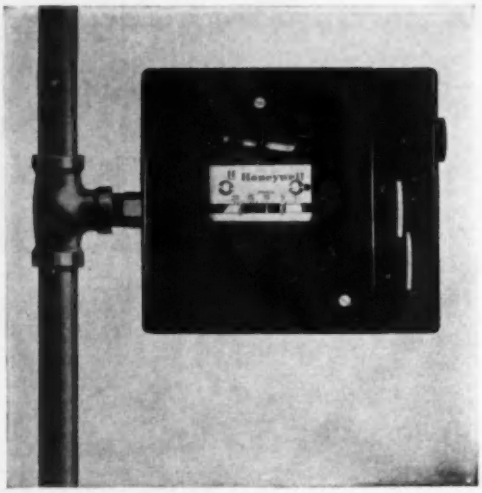

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Elec. Escaut, Belgium	Langerbrugge	2160
Steel Co. of Wales Ltd.	Margam	3150
South Zeeland Power Company, Denmark	Masnedø	2087
Central Electricity Generating Board	Thorpe Marsh	2450
Soc. Meridional di Elettricita	Naples	2558
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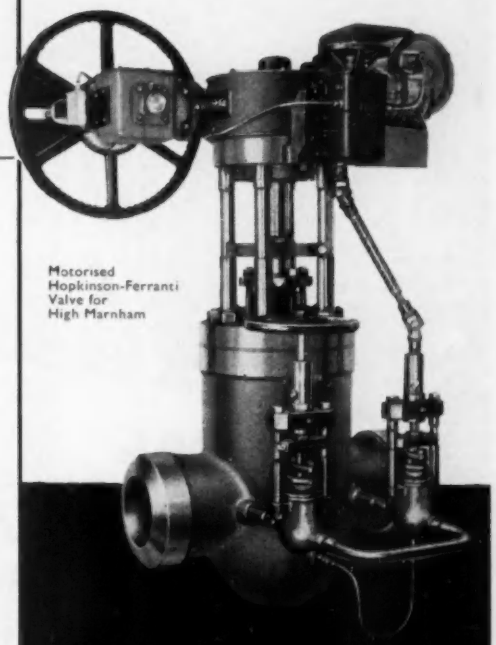
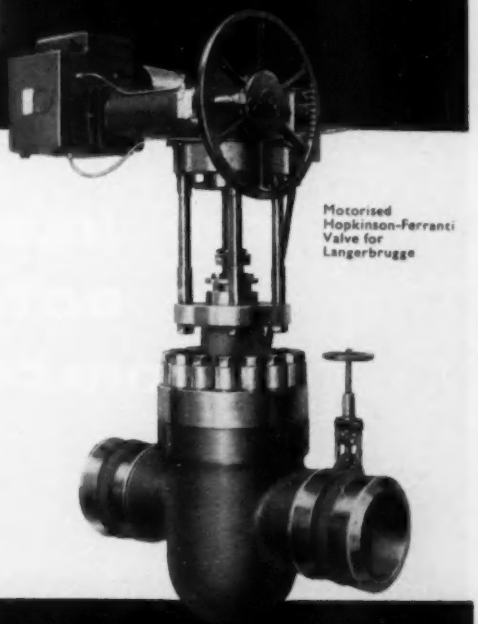
Central Electricity Generating Board	Blyth 'B'	2450
South of Scotland Electricity Board	Kincardine	2450



Motorised Hopkinson-Ferranti Valve for High Marnham



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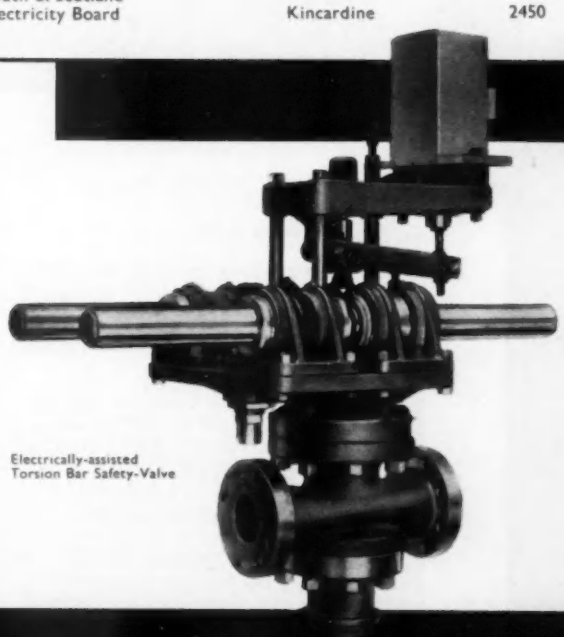

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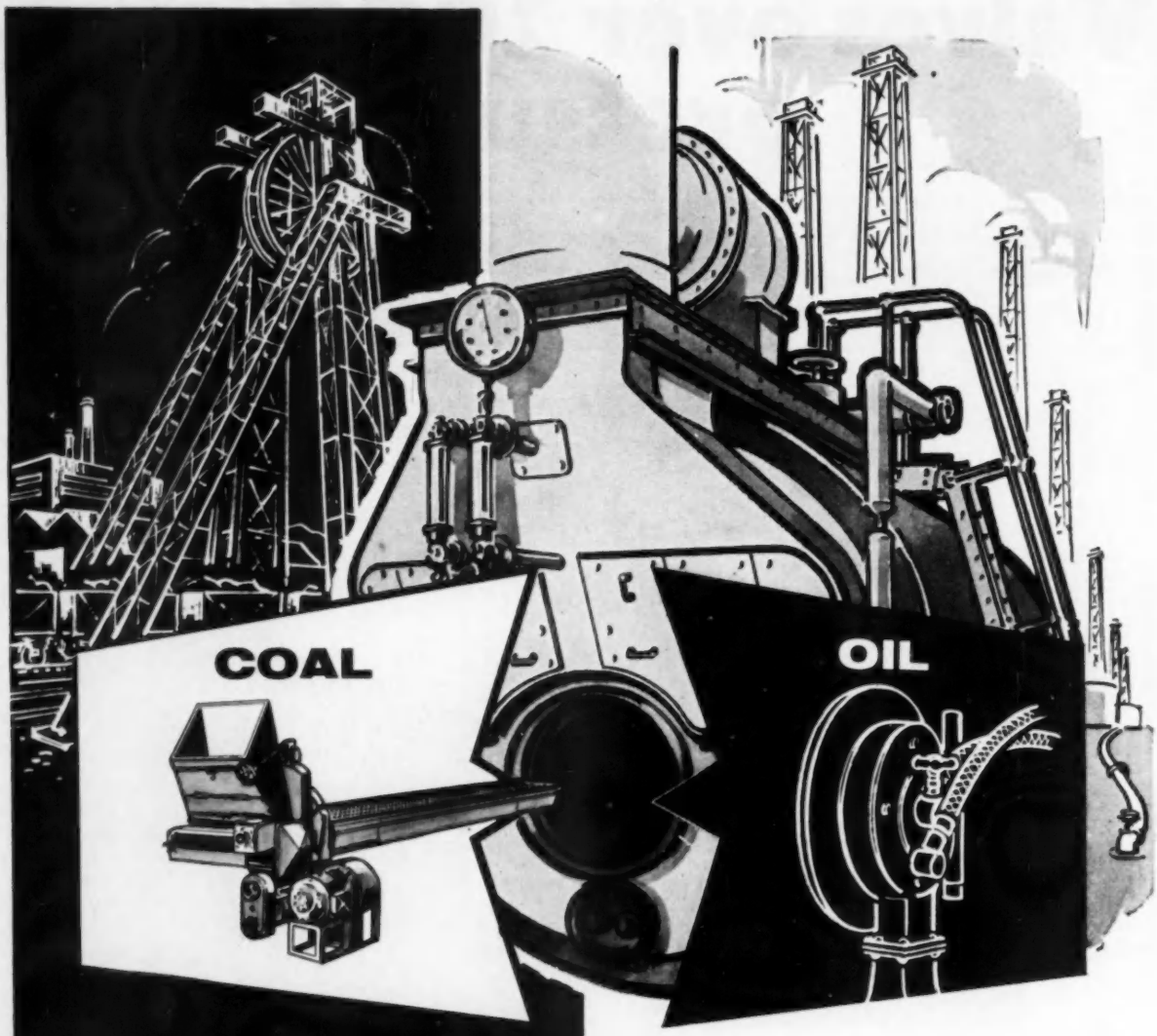

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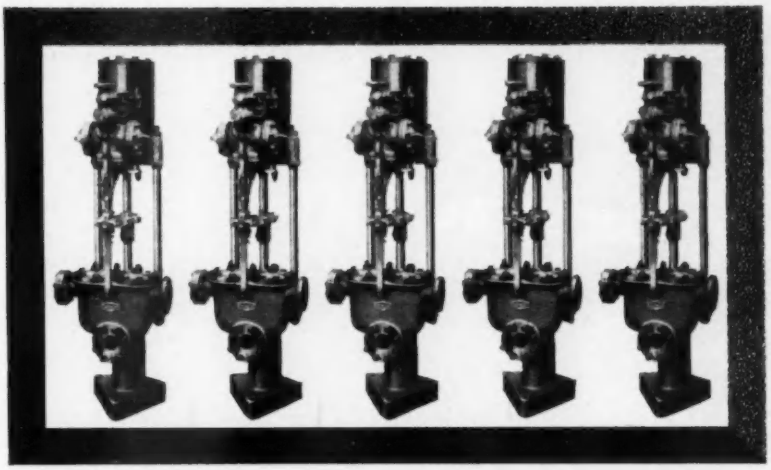

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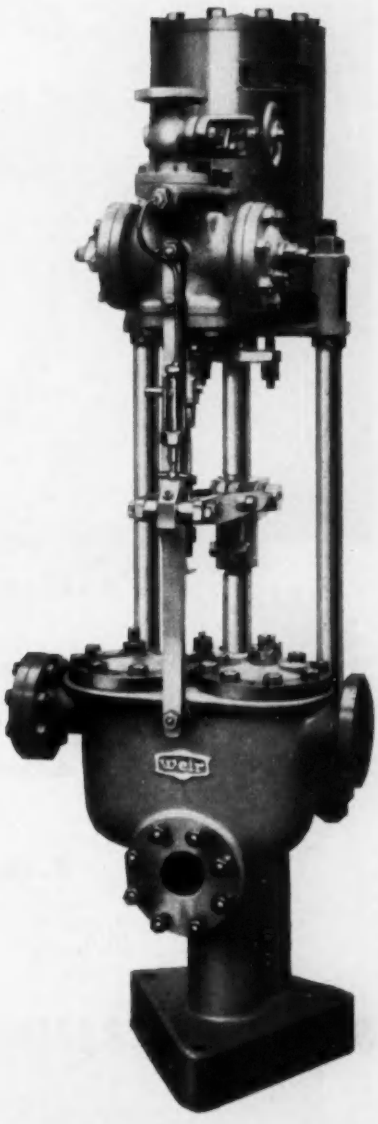

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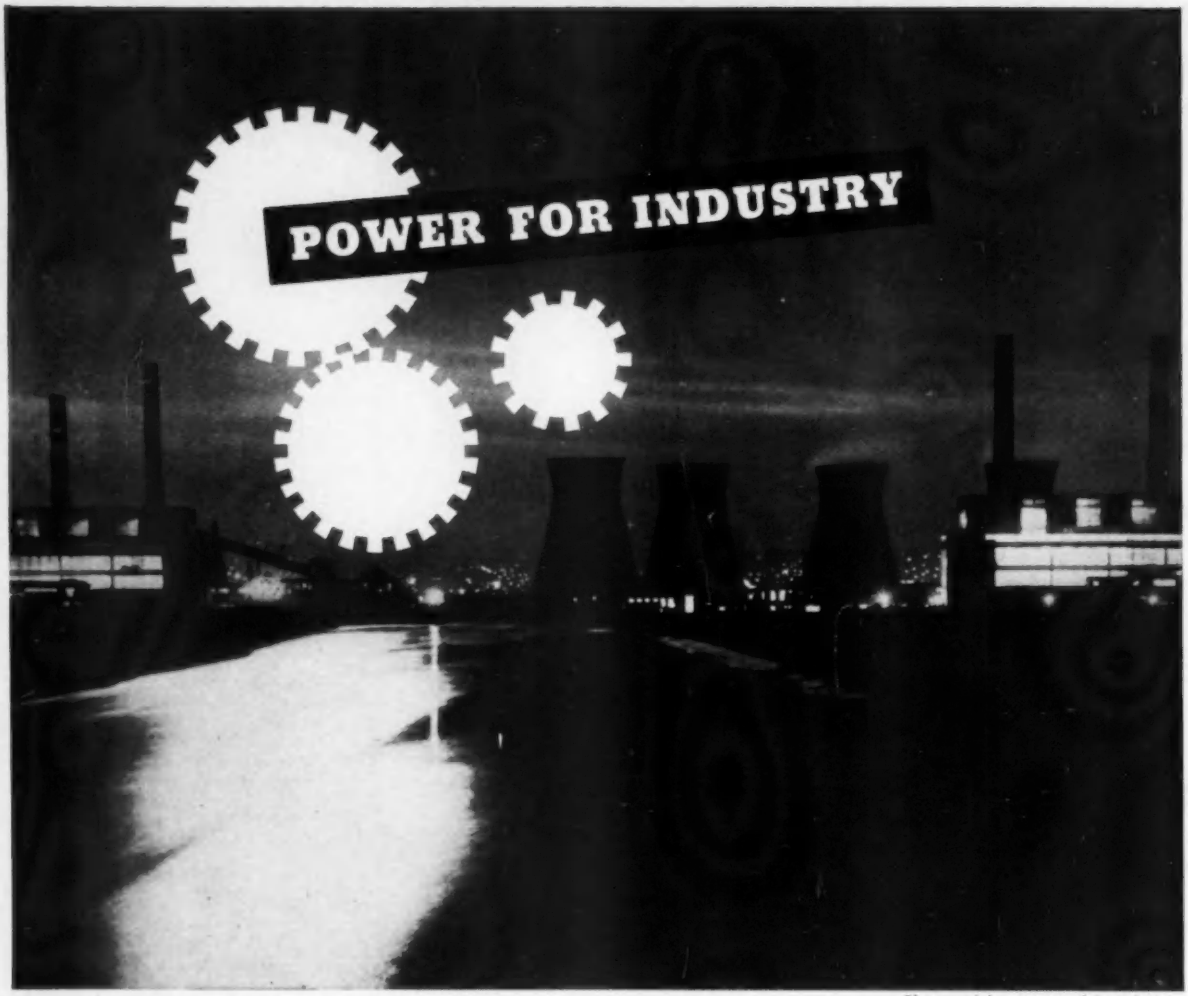

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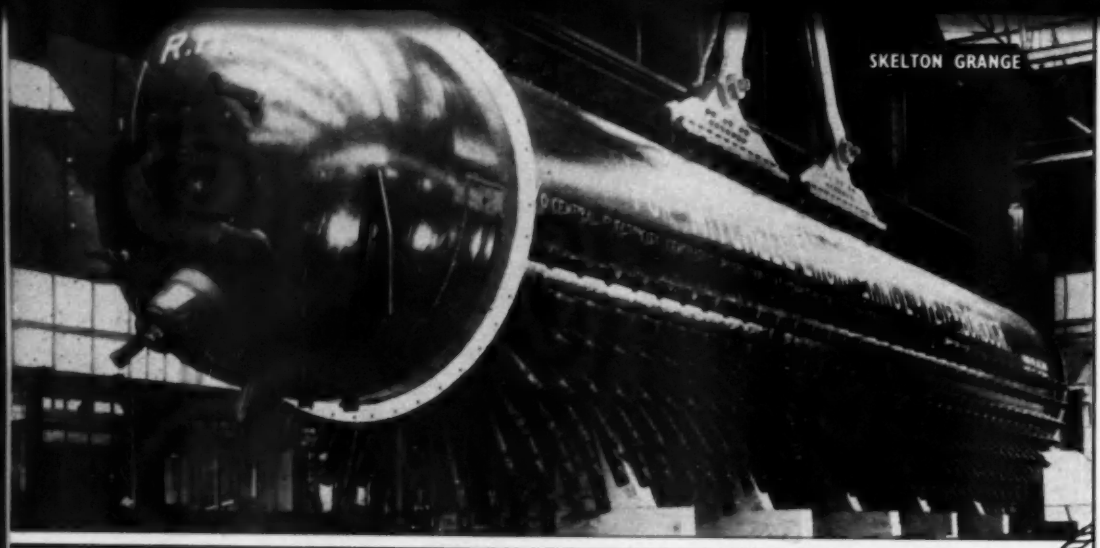

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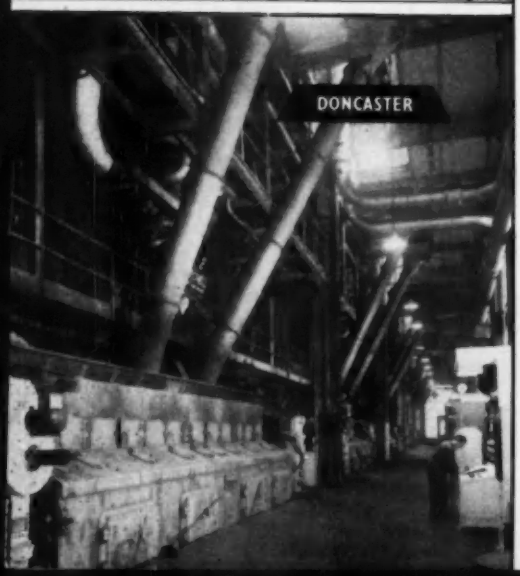

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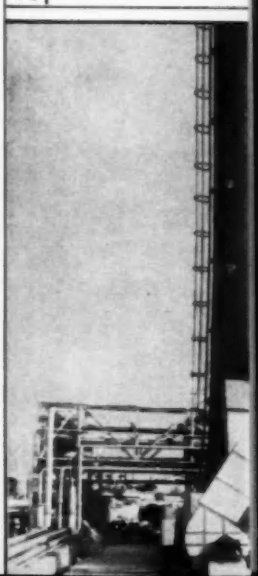

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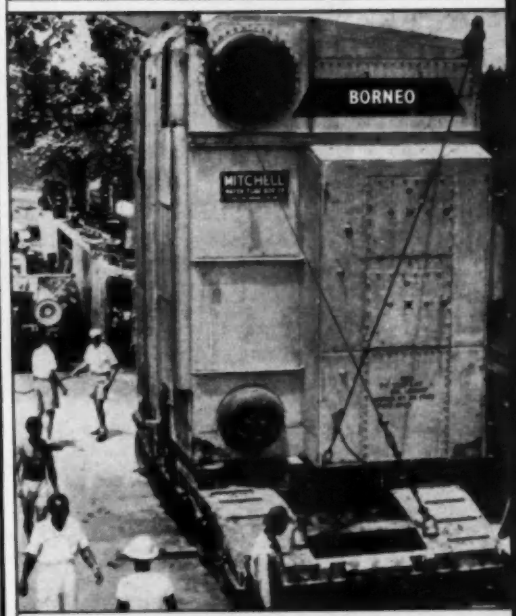
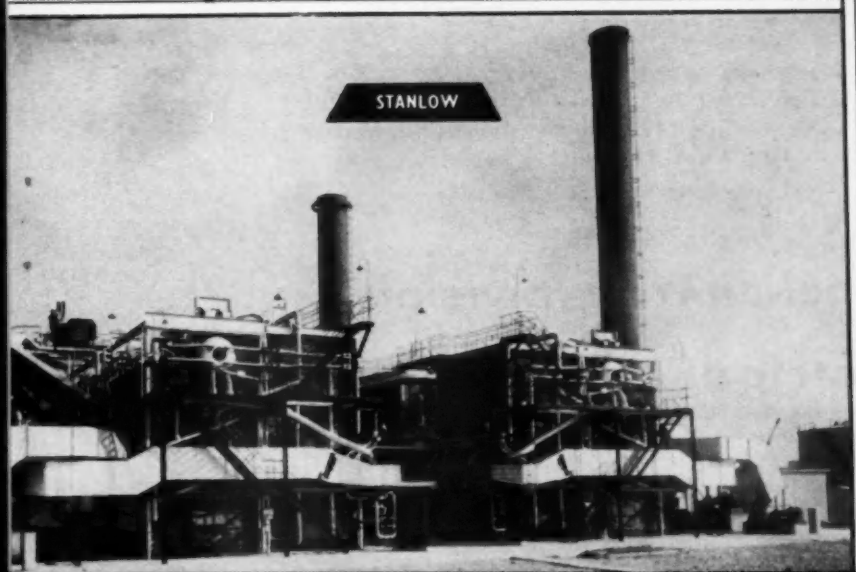
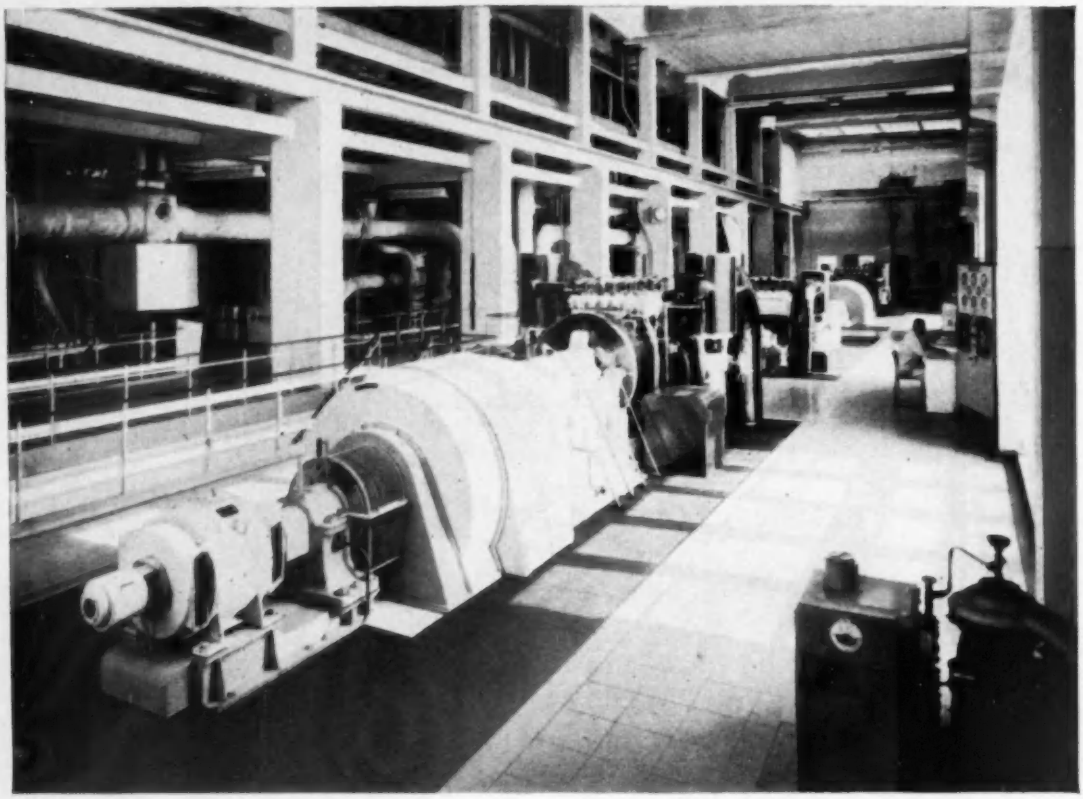




Power from Process Steam



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Engineering and BOILER HOUSE REVIEW

THE OLDEST ESTABLISHED STEAM ENGINEERING PUBLICATION

APRIL 1960

VOLUME 75. No. 4

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The Editor will be glad to receive and consider original contributions, correspondence, etc., of a suitable nature for publication. Stamped and addressed envelopes should be enclosed for the return of any matter considered unsuitable

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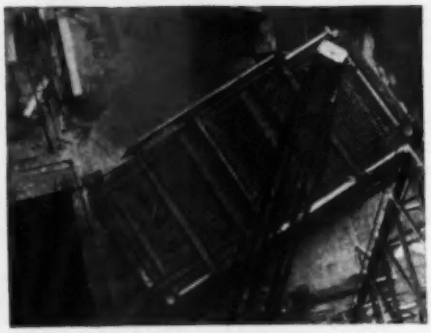
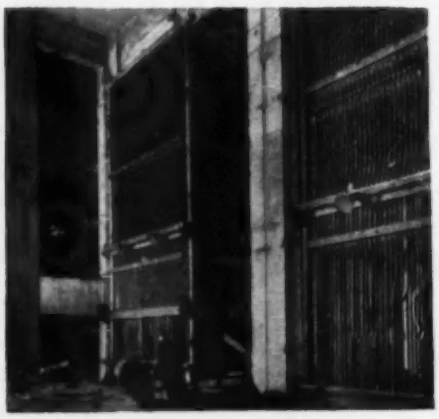
Two of the four Corner-Tube Boilers at the Sheffield factory of Associated Electrical Industries Ltd. Heating Engineers: Saunders & Taylor Ltd.

CORNER-TUBE BOILER



Above and below: Views during installation of the 40 million B.Th.U./hr. Babcock Corner-Tube boilers at the new Shell Centre, London, of the Shell International Petroleum Co. Ltd.
Heating Engineers: G. N. Haden & Sons Ltd.



With the introduction of the Corner-Tube Boiler in Great Britain by BABCOCK & WILCOX LTD., this type of boiler is rapidly being adopted for the modern heating of offices, factories and other large buildings. Corner-Tube boilers were, for example, selected to heat BRITAIN'S LARGEST COMMERCIAL OFFICE BUILDING, the new Shell Centre, London, of the Shell International Petroleum Co. Ltd., and for the new Sheffield factory of the Traction Division of Associated Electrical Industries Ltd. (see illustrations)

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APRIL 1960
VOLUME 75 No. 4

BEAMA ANNUAL REPORT

THE Annual Report of the British Electrical and Allied Manufacturers' Association for 1959-60, while disclosing an output for the industry during the year valued at some £1,400 million—a 9 per cent. increase over the previous year—and at the same time expressing confidence in the future, also refers to certain dangers ahead. Price competition, which has become keener with the prospect of narrowing profit margins, is a trend likely to continue, particularly as local manufacture and intensified foreign competition increase the difficulties in overseas markets. This could give rise to a position of some danger if price levels were reduced to the extent that for the most efficient and lowest cost producers, the margins did not provide for the re-equipment, sales promotion, research and technical development on which the long-term prosperity of the industry, and, of course, the country, depends.

BEAMA membership represents approximately 80 per cent. of the electrical manufacturing industry, and it will be immediately evident that the Association is in a position to materially aid the progress and prosperity of the industry. The Report clearly states the declared objects and basic organisation of BEAMA which make it particularly suitable for the task ahead, while at the same time information is given of services and facilities to be developed and extended in order to meet the future needs of members, and to preserve the unity and common purpose which has proved such a source of strength in the past. Mention is made of measures to extend and strengthen the Association's influence in the important field of Standards; to expand and improve the service to members in connection with overseas trade; and to the establishment of a comprehensive statistical and information service.

The value of these and existing services will, of course, depend on the extent of the co-operation of individual members, and a primary function of the Association will, therefore, continue to be the provision of facilities through which members can co-operate in their mutual interest. It is, for example, considered that one of the chief causes of the excessive price competition, referred to earlier, is the lack of information relating to turnover, price levels, and costs.

Overseas trade becomes more important to the electrical manufacturing industry each year, and figures quoted in the Report are impressive. During the period reviewed, the industry exported products and plant to the value of £285-million—representing more than 10 per cent. of Britain's total manufacturing exports. This figure was £9-million higher than in 1958, and £6-million higher than the previous record year of 1957. Notable gains in exports during the year were a £4-million increase in turbine plant, and a £1.6-million increase in electric motors. Leading markets were, first India—which supplanted Australia, now in second place—South Africa, America, Canada, New Zealand and Rhodesia. Much attention has also been given to the question of trading conditions in Europe, following the establishment of the European Economic Community, and the negotiations leading to the Free Trade Association. A special survey of the potential in the Common Market has been carried out by BEAMA for the electrical industry, and this is to be published very shortly.

An expanding home market is a necessary parallel to these increased exports, and in this connection the Report, while referring to the reduction in Purchase Tax and relaxation of credit control restrictions which have resulted in a large increase in sales of domestic electrical appliances in the U.K., also includes the statement that, "we are only at the beginning of the full development of domestic electrification in this country." There has been considerable progress in recent years, but it still remains a fact that the great majority of British homes are not yet equipped to obtain the full benefit from their electricity supply.

Readers of this journal will, perhaps, be familiar with developments on the heavy electrical plant side, but figures quoted in the Report do, we feel, bear repetition. Plant commissioned during the year for the Central Electricity Generating Board, included the first unit of 200-MW capacity, while orders received during the year included units rated at 300-MW and 350-MW—the largest single-shaft designs planned so far—and the second 550-MW cross-compound set for Thorpe Marsh. At the other end of the scale, a development of interest was the commissioning, at Princetown, Devon, of a 3-MW, completely automatic generating set powered by a Bristol Proteus turbo-prop engine—the first remote-controlled peak-load power station in the U.K., and one which may prove to be a prototype for export purposes.

Points and Pointers

BUDGET FOR DRAGON PROJECT The Board of Management of the O.E.E.C. high-temperature reactor project (Dragon) held its third meeting, under the chairmanship of Dr. Sigvard Eklund of Sweden, on February 23rd. The meeting approved the project's budget for 1960-61, which envisages an expenditure of £2,830,000, which represents some one-fifth of the total forecast expenditure of £13,600,000 over the five-year period. The budget includes £950,000 for the reactor plant and buildings, £910,000 for extra-mural research and development, and £970,000 for the maintenance and work of the project staff at Winfrith Heath, Dorset. The Board approved that the following offers of appointment should be made: head of administration, R. K. Andresen of Norway; chief engineer, Gianfranco Franco of Euratom; deputy chief engineers, S. B. Hosegood, U.K., and R. Tron of Euratom. These appointments will complete the senior staff structure of the project. The Board noted that, of a total of 14 senior staff, including the chief executive (Mr. C. A. Rennie), half are from the U.K. and half from the other signatories. A large proportion of the staff required for design and construction of the reactor experiment has already been recruited, and it is expected that the remainder will be available within the next three or four months. The staff will eventually number some 240. The Board approved proposals for collaboration between the Dragon project and the United States Atomic Energy Commission. Under these proposals, information will be exchanged concerning the development of the Dragon project and of the similar reactor project under construction in the U.S.A. concerning contracts between the U.S.A.F.C. and the Philadelphia Electric Company and General Dynamics Corporation. Finally, the Board extended for a fourth year, the terms the office of Dr. Eklund (Sweden) and Sir William Penney (U.K.) as chairman and vice-chairman respectively.

LOANS FOR PURCHASE OF INDUSTRIAL SOLID FUEL FIRED APPLIANCES The National Coal Board have recently made arrangements with Forward Trust Limited, Birmingham (a subsidiary of Midland Bank Limited), to introduce a completely new, and what is considered a very attractive loan scheme, for the purchase and installation of solid fuel fired appliances. The loans are offered for all modern domestic solid fuel fired appliances; for central heating installations in dwelling houses and in commercial premises such as office blocks, flats, shops and so on; and for small industrial installations such as laundries, etc. These loans will cover any installation which costs more than £20. Repayment can be made over periods up to five years, except in the case of appliances costing less than £50, when the maximum repayment period will be two years. No deposit will be needed, but the first monthly instalment will be payable when the advance is made. Interest will be 5 per cent., and will continue at the same rate for the whole period of the loan. For advances of less than £50, there will be a total fixed charge for interest of £5. For new advances the rate of interest will be subject to alteration on changes in the general level of interest rates. The loans will provide for the total cost of solid fuel equipment, and include the cost of equipment and installation, and any consultant's fees when these are necessary. For the domestic consumer, the loans will be available for the purchase of all the approved appliances on the lists which are published twice yearly by the Coal Utilisation Council, and the Solid Smokeless Fuels Federation. A consumer wishing to take part in the scheme will be able to obtain from advertisements in the local press or from the National Coal Board, the names of those approved appliance distributors and heating engineers in his particular district who have agreed to operate the scheme. He will be guided in this way towards suppliers who aim to provide the highest standard of service to the customer. Loans for industrial appliances will cover the total cost of the plant, including the coal and ash-handling plant. The N.C.B. claims that solid fuel provides the cheapest form of heating, because solid fuel appliances are cheapest to buy and cheapest to run, while maintenance costs are lower than for other forms of heating. The board are confident that their scheme can bring real advantages to millions of householders and to many other users of solid fuel, and the terms on which it is being offered bring it within the reach of everybody.

THE INSTITUTION OF PLANT ENGINEERS The 1960 annual conference of the Institution of Plant Engineers will be held at the Grand Hotel, Scarborough, from May 4th to 6th, and will be the occasion of a number of authoritative papers of wide scope and interest. In view of the exceptional response to similar invitations in past years, the Council of the Institution is again making the conference available to a number of non-members by inviting some of the principal industrial concerns to nominate senior staff to attend. Following the presidential address by Mr. E. C. Stevens, M.A. (Cantab.), B.Sc. (Tech.), A.T.I., two principal papers are to be presented and discussed. The respective authors are Dr. Richard Weck, Ph.D., M.Inst.C.E., M.I.Mech.E., Director of Research, British Welding Research Association, and Mr. F. S. Walker, M.C., chairman of Lever Brothers, Port Sunlight, Limited. Dr. Weck's paper has as its subject "Developments and Problems in Welding," whilst Mr. Walker will deal with "People—The Most Important Factor in Industry." In addition, there will be group discussions on the following papers:—*The Training and Education of Supervisory Staff*, to be opened by Mr. J. Wilson, J.P., B.Sc., B.Com., M.I.Mech.E., Hon.M.I. Plant E., Director of Education and Training, The British Motor Corporation. *Developments in Materials of Construction,*

to be opened by Mr. K. S. London, B.Sc. (Eng.), M.I.Mech.E., F.I.Plant E., Works Manager (Northwich), The Associated Ethyl Co. Ltd., and *The Engineer's Function in Industrial Safety*, to be opened by Mr. J. MacColl, B.Sc. (Eng.), H.M. Deputy Chief Inspector of Factories. The conference dinner will be held on Thursday evening when the principal speaker will be Mr. Philip Mayne, M.A. (Cantab.), M.I.Mech.E., Technical Director of the Billingham Division of Imperial Chemical Industries Limited.

IRON AND STEEL Recently issued statistics show that the British steel industry achieved a record output of ingots and castings during the month of February. Steel production was running at an annual rate of over 25-million tons, and it is estimated that the industry is now operating at about 98 per cent. of its installed capacity. The Iron and Steel Board has stated that, in the final quarter of last year, steel consumption was 12 per cent. higher than in the comparable quarter of 1958, though it was still about 3 per cent. below the high level which was reached in the third quarter of 1957. Steel stocks held by private industry began to increase once again in the last quarter of 1959, although this was accompanied by a heavy fall in stocks held by public organisations. The continued rise in steel production in January and February this year, the Board adds, indicates that consumption is increasing further, and that stock building is probably now taking place on a substantial scale, at least in the private sector of industry. The Board also says that the results of the annual survey of capital expenditure in the iron and steel industry show that expenditure in 1959 amounted to £99-million, compared with £105-million in 1958. It is considered that the actual expenditure this year on capital development is likely to be of the order of £120-million to £125-million. A large part of the increase over the 1959 expenditure is due, of course, to the strip mill programme.

POSSIBLE SITES FOR COAL-FIRED POWER STATIONS IN NOTTINGHAMSHIRE The Central Electricity Generating Board states that suitable sites for large coal-fired power stations have been found at two places in Nottinghamshire ; one is at Holme Pierrepont, about two miles south-east of Nottingham, and the other at West Burton, about two miles south-west of Gainsborough. The search for sites has been concentrated near the Nottinghamshire and North Derbyshire coalfield, which is the largest producer of coal for electricity generating station requirements. Mining in this coalfield is extensively mechanised, and a number of new sinkings or major reconstruction schemes are in hand. As a result, the efficiency and productivity of this coalfield, already well above the average for the country, is expected to rise still further. Output will rise as well, and this is particularly true of the small coal that large power station boilers can burn efficiently. The West Burton site adjoins an existing railway line over which large quantities of coal can be drawn from collieries served by the network of railway lines in the northern part of the coalfield. The Holme Pierrepont site can be railway connected by a short spur off the line now being constructed to link the new Cotgrave Colliery with the railway system in the southern part of the coalfield. Each of the sites is considered suitable for a station of about 2,000-MW capacity, and consuming as much as 5 million tons of coal a year ; there is also the possibility of further development at each site at a later date. The sites are close to the River Trent, which is the only adequate source of cooling tower make-up water for large power stations in the East Midlands. The investigations in the East Midlands have also revealed sites suitable for future power stations at Cottam and Ratcliffe-on-Soar, together with a site at Market Warsop, that will become suitable if the dry cooling-tower technique proves to be a commercial proposition. Any stations that might be authorised to be built on these sites would incorporate large boiler and turbine units, and would operate at the high efficiencies that are characteristic of stations now in operation or planned in the East Midlands, such as Drakelow " A," " B " and " C " (2,220-MW), Willington " A " and " B " (800-MW), Castle Donington (600-MW), Staythorpe " A " and " B " (720-MW), and High Marnham (1,000-MW). The association of advanced techniques of power generation with expanding coal production in the most highly-mechanised coalfield, is aimed at achieving the cheapest possible generation of electricity from coal, and it is the latest example of the forward planning that is helping to hold down power generation costs at the present time.

STANDARD ENGINEERS' CONFERENCE Mr. Lewis Wright, a past chairman of the British Productivity Council and Chairman of the T.U.C. Production Committee, will open this year's one-day conference of engineers and others concerned with the application of standards in industry. The conference—the sixth of its kind—will be held on Wednesday, May 11th, at the Connaught Rooms, Great Queen Street, London, W.C.2. This conference is organised by the British Standards Institution jointly with the Institution of Production Engineers. Applications for tickets (35s. each) should be sent (at latest by April 27th) to the Secretariat, I.P.E./B.S.I. Committee, British Standards House, 2, Park Street, London, W.1. The theme of the morning session at the conference will be some of the main problems met with in the day-to-day working of a standards department, and the application of standards in the production shops. These will be dealt with under two headings: (1) The adoption of British Standards in the individual firm—for example: the format of British Standards ; the timing of the introduction of standards ; obtaining standard products from suppliers. (2) The use of standards in production and quality control. These subjects will be introduced by speakers from industry with wide experience of the problems, and will then be open for discussion. The action taken on a resolution at the 1959 conference about the formation of an association of standards engineers and others concerned with standards will be the first item for discussion in the afternoon session. Following this, the conference will consider some aspects of international standards work, in particular, means of promoting interchangeability of inch and metric sizes, and the problems arising in relation to the Common Market and the European Free Trade Association.

Progress at Berkeley

IT is now just three years since construction work commenced at Berkeley nuclear power station site, which is situated on the left bank of the River Severn, some 15 miles from Gloucester, and 26 miles from Bristol. Today, the civil engineering work is nearing completion, the mechanical engineering work is about 75 per cent. complete, and the main effort is now concentrated on the reactor installation. It is anticipated that No. 1 reactor, with its associated 85-MW turbo-alternators (Nos. 1 and 2) will be commissioned during the first quarter of 1961, to be followed by No. 2 reactor and Nos. 3 and 4 generating sets during the third quarter. The nett guaranteed output to the national grid will be 275-MW. It may be remembered that the station has been designed, and is being constructed by the AEI-John Thompson Nuclear Energy Co. Ltd, for the Central Electricity Generating Board. The civil engineering work in the reactor area has been carried out by John Laing & Son Ltd., while other civil work in the conventional area is the responsibility of Balfour Beatty & Co. Ltd. The power output from the completed station will be nominally 332-MW, of which approximately 12 per cent. will be required to drive the gas-circulating blowers, and approximately 4 per cent. for other ancillary services at the station.

When we visited the site at the beginning of March, we had the opportunity to go inside the pressure vessel of No. 1 reactor to see the work which is being carried out on the construction of the graphite core. Some idea of the extreme clean conditions which have to be maintained inside the vessel during the carrying out of this work, can be gained from the fact that all work-people, and any others entering the vessel have to pass through airlocks, remove all watches, rings, etc., and then strip to their underwear and put on protective clothing which is fastened by means of tapes, since even one lost button in the reactor core could have very serious results. The reactor pressure vessel is a dome-ended cylinder, 80-ft. high by 50-ft. dia., and it is fabricated from 3-in.thick steel plate, increased to 4-in. thickness at the gas inlet and outlet ducts. It weighs 1,000 tons, and is supported on 18 "A" frames. After No. 1 pressure vessel had been completed, the interior, including the graphite support plates, was scrupulously cleaned. Then the 4-in.-thick graphite support plate area, containing 3,275 cavities, was divided into quadrants. Beginning with the first quadrant, straight edges are accurately positioned to form a right-angle. In this, four graphite blocks were placed to act as a locational centre and mounted on a fixed base. Flat movable ball-races were mounted on the adjacent cavities and subsequent blocks are married up with the locational blocks. Once the first layer in this quadrant was completed, the straight edges were removed and re-aligned on the second quadrant, so that eventually the whole first layer of the graphite core was laid. This core which contains the fuel elements and control rods, and serves as moderator and reflector, is a structure consisting of about 97,000 pieces of graphite, weighing in all some 2,000-tons, in the form of blocks and tiles, built up into a regular polygonal prism, 30-ft. high and 48-ft. dia. overall.

The core proper, that part of the structure in which the fuel elements are located, is 24-ft. high and 42-ft. in dia. and is surrounded by the reflector, which has a radial thickness of 2-ft. and an axial thickness of 3-ft. at the top and bottom. The core is built up of 12 layers of 8-in. by 8-in. by 30-in. graphite bricks, successive layers being interleaved with two thicknesses of graphite tiles, keyed together, as can be seen in Fig. 3. The vertical channels for the fuel elements and coolant consist of a 4-in. dia. hole in each brick and tile, with two diametrically-opposed keyways, $\frac{13}{16}$-in. wide by $\frac{3}{4}$-in. deep, cut in each hole to accommodate the fuel element support struts. Vertical channels, 3-in. dia. for control rods, flux measurement and a neutron source are formed by machining quadrant grooves from the corners of certain bricks; these bricks are earmarked to be grouped in fours so that the four quadrant grooves form a cylindrical channel, as can be seen in Fig. 4. All the bricks are machined from extruded graphite blocks of nominal size 8.55-in. square by 32-in. long, the finished size tolerance being $\pm$ 0.002-in. The core rests on the 4-in.-thick steel support plate, and the whole assembly is carried on cross-braced ring girders. Positive location is effected at the plan centre of the pressure vessel by having the four central columns of the core spigoted to the support plates.

Fig. 1. View showing the two 200-ft. high reactor buildings at Berkeley Nuclear Power Station. Beyond is the River Severn from which the cooling water supply of 21 million gal./hr. will be drawn.

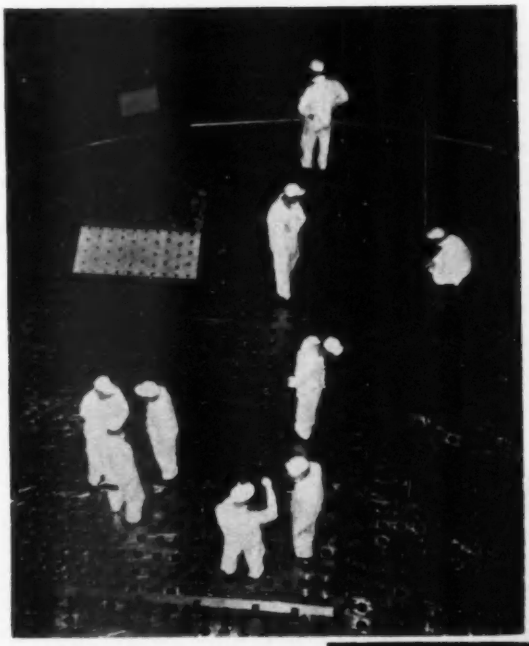


Fig. 2 (above). Interior of No. 1 pressure vessel showing the 4-in. thick steel support plate for the 2,000-ton graphite core.

Fig. 3 (right). The first layer of graphite is here seen nearly completed. The graphite core will ultimately be 30-ft. high and 48-ft. in dia.

Fig. 4 (above, right). Handling one of the "bricks" in the first layer of the graphite core.

Fig. 5 (left). Some of the 3,275 stainless steel tubes rising up from the burst slug detector valves and precipitators.

Burst slug detection equipment

Through the graphite core there are the 3,275 channels which will contain the natural uranium rods—there being 13 rods to each channel. To keep radio-active fission products contained, each rod is canned in a helical finned magnesium alloy container, and the complete assembly is called a fuel "cartridge." If the can suffered a minute puncture, there would be contamination of the gas circuit. Any continuation of this defect would result in progressive contamination which would interfere with the efficiency of the reactor. It is, therefore, essential to detect and remove the faulty element. To detect such a puncture, 3,275 stainless-steel tubes are, therefore, passed into the pressure vessel, and the end of each tube is located adjacent to the outlet of a fuel channel in the graphite. Once every 30 min. the carbon dioxide gas passing through a group of four channels will be sampled by the respective tubes and passed through a burst-slug detector valve which can isolate a channel from a group of four should a high contamination level be detected. From the burst-slug detector valve, the CO_2 "sniff" will be led to a precipitator which is, basically, a taut rotating wire connected to a high voltage supply, and the "sniff" or gas sample, passes over the wire. The high voltage causes contamination products in the gas to be deposited upon the wire. As the wire travels forward, any contamination will be picked up by a radiation detector, and this information sent to a central computer system which will cause an audible warning to operate if the contamination level is too high. The sequence of events, therefore, is that there will be an audible warning, the computer, on detection, will give a complete record of the faulty channels, and will indicate in which group of four channels the fault lies. The detector valve will then indicate which one of the four channels is affected, and this information will be passed to the charge face and the cartridges in the faulty channel will be removed and replaced.

The station will be controlled from the control room in the turbine house, and from this point it will be possible to override secondary controls in either reactor.

Heat-exchangers

Each of the 16 heat-exchangers, or boiler units (eight for each reactor) were manufactured by John Thompson Limited, and are now erected on site. Each unit is 70-ft. high by 17-ft. 6-in. dia., and weighs 133-tons. For fabrication at the John Thompson works at Wolverhampton, the vessels were divided into seven sections, comprising five cylindrical sections forming the body of the vessel, and a domed section at each end. The cylindrical body-sections were each fabricated from two plates, roll-formed cold to shape, then welded together. The domed-end sections of the vessels were similarly prepared at Wolverhampton so as to reduce sitework to a minimum. These domed sections are made up of pressed plates assembled and welded on jigs. Operations included fabrication and welding into position the 6-in. thick compensator rings which strengthen the vessel at the gas ports, and provide connection to the gas-ducting connecting the heat-exchanger to the reactor vessel. Water will be fed to the boilers at 170 deg. F., and they will generate steam at two pressures, viz., 305 and 62-lb./sq. in., and at 612 deg. F., and deliver it to the inlet stop valves of the four turbines.

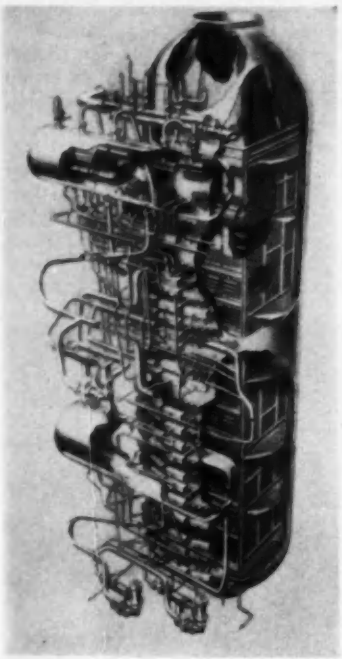


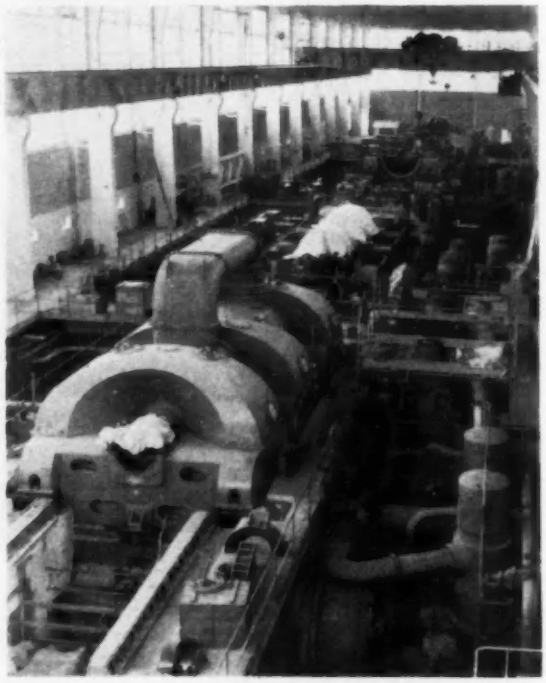
Fig. 6 (left). Cut-away view of one of the 70-ft. high heat-exchanger or boiler units, of which there are eight per reactor.

Fig. 7 (right). Interior of turbine house showing No. 1 turbo-alternator set (85-MW) virtually complete, and No. 2 set some two-thirds complete.

John Thompson Limited have also manufactured the two reactor pressure-vessels, the thermal shielding surrounding them, and the diagrids which will support the 2,000-tons of graphite forming each reactor core.

Turbine house

The turbine house, a steel-framed building with side cladding of brickwork and glass, is structurally complete and internal finishing is in progress. No. 1 turbine is installed, and the stator of the 85-MW alternator is now on site. No. 2 turbine is about two-thirds complete. Each generator will supply 50-c/s, three-phase a.c. at 11,800 volts, and will be cooled by hydrogen, fan-circulated at 30 lb./sq. in. The circulating-water requirements of the station will be 21-million gal./hr. of water pumped from the River Severn through intake screen chambers situated about 650-ft. off-shore. These structures, together with a man-access tower, were built inside a circular coffer-dam formed of steel box-piles. Concreting on the intake screen chambers was completed towards the end of last year and the intake works include an access shaft and tunnel connected to the shore, to enable station operatives to maintain the intake works at all states of the tide. Each intake screen chamber is linked with the c.w. pump house by vertical shafts and horizontal tunnels, each tunnel being 1,000-ft. long and 10-ft. dia. The tunnels were driven through rock, and were constructed with pre-cast concrete segments finished off with " Gunite " lining. The pump house was excavated to a depth of some 70-ft. from the surface. The circulating-water outfall works have been built within a steel cofferdam 130-ft. wide and extending 275-ft. into the river, and include a permanent access bridge to controlling sluice gates and outfall channels, all in reinforced-concrete. A baffle wall of steel piles has been built for a length of 1,500-ft. on either side of the intake structures to prevent the outfall water being recirculated through the cold-water intake.



FUEL CHARGE/DISCHARGE EQUIPMENT

The charge face machinery for the two reactors at Berkeley is designed to enable the fuel elements and control apparatus to be changed while the reactors are operating on load. The specialised machines for these servicing operations have been designed and manufactured by John Thompson Ordnance Company, Wolverhampton.

For many years, the company has been engaged upon

Government and Admiralty contracts for such equipment as gun-firing directors and rocket launchers, as well as gearboxes and control apparatus, both mechanical and electrical, for the automation programmes of many British industries. But for the past three years much of the manufacturing capacity of the company has been devoted to the production of this specialised charge-face machinery for Berkeley.

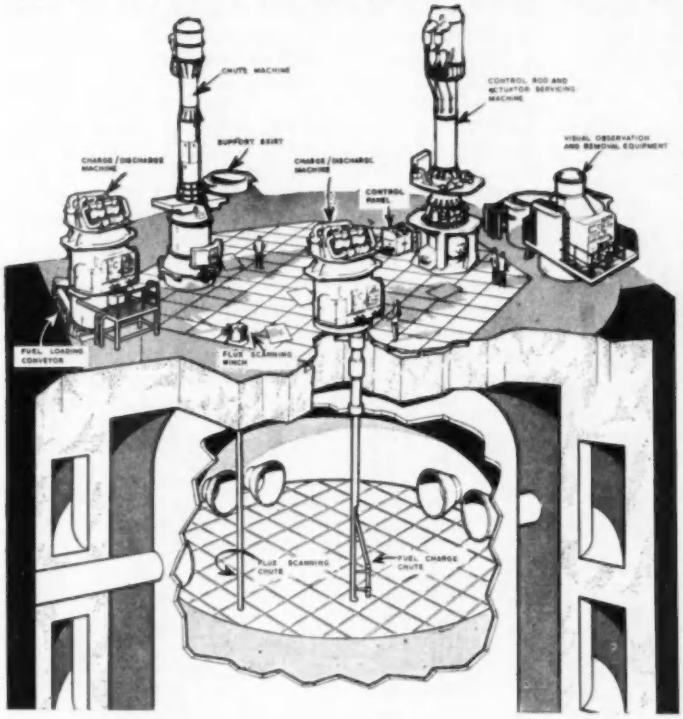


Fig. 8 (above). Diagrammatic arrangement of the charge face floor of one of the two reactors at Berkeley.

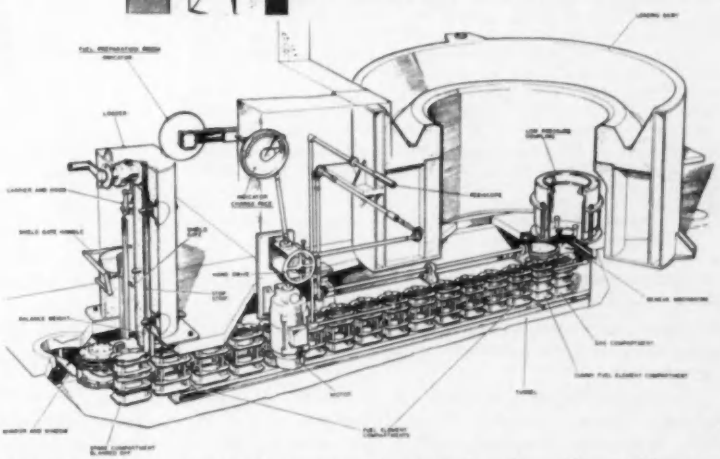


Fig. 9 (right). Arrangement of fuel element loader and conveyor that feeds the fuel elements into the fuel charge machines.

Recently, we had the opportunity of visiting Wolverhampton to see this equipment in course of manufacture. Briefly, the functions of this machinery, operating from the charge floor on top of the reactor, are to enable fuel elements to be changed as required, control rods to be withdrawn for servicing, visual observation to be made of the fuel channels by closed-circuit television, and flux scanning to be carried out to facilitate assessment and programming of future fuel needs. A common requirement in all these functions is that they must be carried out while the reactors are on load.

The reactor core contains 3,275 vertical fuel element channels arranged on a square lattice at 8-in. pitch, as well as 132 control-rod and safety-rod vertical channels. The 13 fuel elements, stacked in series in each fuel element channel, are supported from the bottom of the core by a deflector or dummy element, and a gag. This gag controls the flow of carbon-dioxide coolant up the channel. The two main operations to be carried out on the fuel channels are—the removal of fuel elements as they near exhaustion, and their replacement by new elements, and the changing of a gag, as required, to control the coolant gas flow.

The exchange of fuel elements, etc., is carried out by a machine which is enclosed in a pressure casing and suitably shielded. The main machinery on the charge face floor of each reactor consists of a charge machine, a discharge machine, a chute machine, and a control rod and actuator servicing machine (CRASM).

The main constituents of each of the 100-ton charge/discharge machines are: fuel element grab, grab winding mechanism, and control switches, winding gear-box assembly, drives to magazine and latch mechanism, chute gear-box and standpipe operating-gear, a control panel and its mechanism, and circulating and cooling equipment. Basically, the machine is a winding mechanism controlling a grab which can engage or disengage from a fuel element, etc., as required. A rotating magazine capable of accommodating 13 fuel elements is fitted, as also are a reflector, a gag and a spare, and four concrete plugs which seal the chute. Below and above the magazine shield, plugs are fitted to reduce the effect of radiation; in the bottom plug is a rotary shield to seal-off the channel used by the grab. To connect with, and control the fuel element chute when it is in the reactor, a protruding

unit is situated at the bottom of the machine. All of this machinery is contained in the pressure casing, shielded on the outer side to give the necessary protection, and built to withstand the working pressure in the reactor. For operating the machinery, both power and hand drives, electric indicator wiring, etc., pass through the pressure casing and shielding to a control panel in which routine

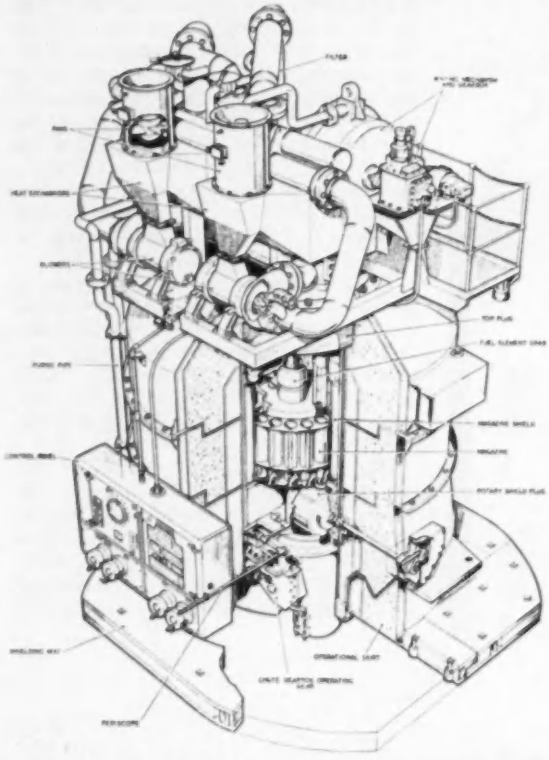


Fig. 10 (above). Cut-away diagram showing arrangement of charge and discharge machine for handling fuel elements in the Berkeley reactors.

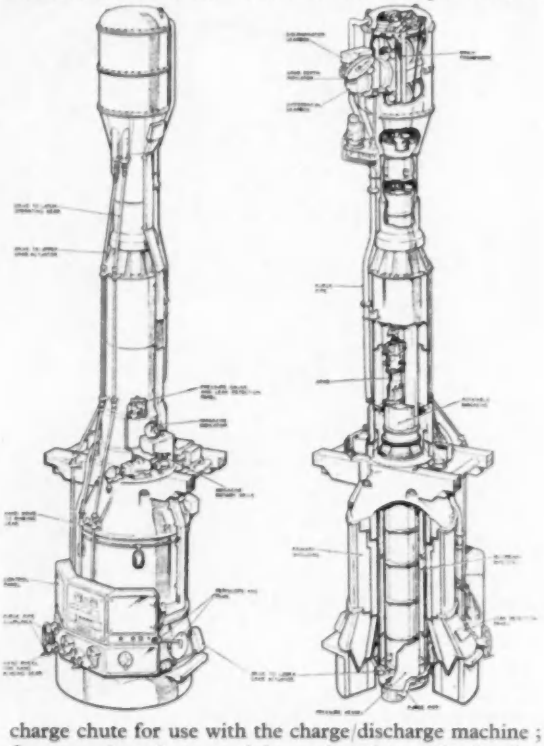
Fig. 11 (right). Chute machine for placing chutes in position to connect the charge face floor with the reactor core.

operations can be automatically controlled by means of relays, uni-selector switches and a selective card system. A fully comprehensive system of interlocks (both mechanical and electrical) prevent actions which may cause damage.

The charge/discharge machine can be used to discharge elements from the reactor into its magazine, and from there, down the discharge well to the disposal flask. In such circumstances it is a discharge machine. Internally, it may be highly contaminated and is not normally used for any other purpose. The machine is used as a charging machine when it charges its magazine with new fuel elements from the loading conveyor and afterwards charges, from its magazine, an empty reactor channel. In order that it may operate, a machine must rest on a skirt; the loading conveyor skirt, the discharge well skirt, or an operating skirt. When not operating, it rests on a parking skirt. Basically, all skirts are similar, except in shielding properties and height. The machine is lifted and transferred from one skirt to another by crane. A cleansing and cooling system, normally employing air, but substituting CO_2 when connected to the reactor, is fitted on the top of the machine. The fans are supplied by trailing cables which also provide power for the machine when it is on a skirt. When the machine is lifted, auxiliary contacts on the crane arms replace power cables to provide power for an adequate cooling supply. When resting on the operating skirt, the machine is connected to the standpipe valve, and has gear fitted by which the valve is opened or closed to allow access to the reactor. Three machines are provided for each reactor—the charge and discharge units on the charge face for operational purposes, and a standby machine which is kept in the maintenance workshops.

Chute machine

The chute machine, which is about 50-ft. high, enables various chutes to be placed in the reactor to serve as a guide along the 40-ft. gap between the charge-face floor and the reactor core. The machine incorporates the



charge chute for use with the charge/discharge machine; flux scanning chute used in conjunction with the flux scanning winch; fixed absorber chute used with the control rod and actuator servicing machine; thermocouple chute to work with its own winch vessel; reactor periscope; standpipe plug which normally closes and shields the bore through the charge standpipe; metal samples handling chute; graphite sample trailing thermocouple chute; and charge standpipe sealing plug.

Two machines are being supplied for each reactor charge face, the spare replacement unit not being fitted with shielding. The two machines are interchangeable in one shielding. The chute machine is equipped with a

rotatable three-chambered magazine to store two chutes. These chutes are handled by a grab and winding mechanism which is remotely operated both at the top and bottom of the machine. Two cables support the grab, and they are operated by a torque differential gearbox which ensures that the main cable always carries ten-elevenths of the total load while the secondary cable carries the rest. Outside the main shielding that supports the pressure casing, is a panel carrying the operating controls and instruments to indicate the state of the machine. The chute machine is placed by the crane on an

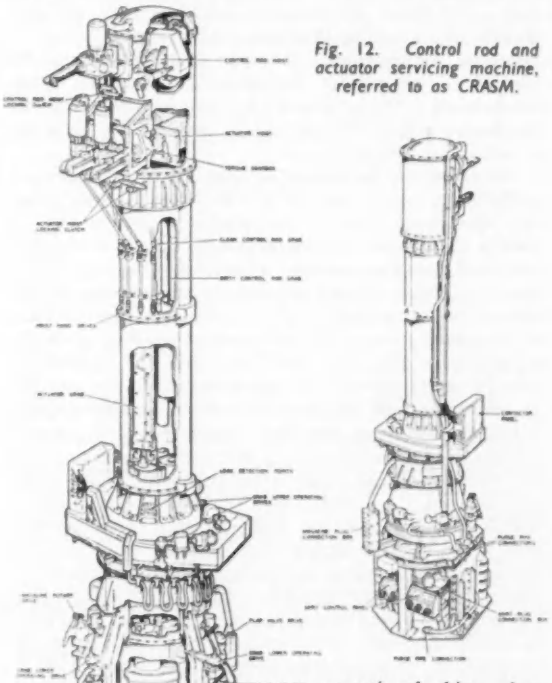


Fig. 12. Control rod and actuator servicing machine, referred to as CRASM.

operational skirt when working over a charge point over the inspection well, the discharge well, or the decontamination well. Among the interlocks, all of which operate "fail to safety" and are designed to prevent incorrect operation of the machine, are electrical interlocks whereby lifting cannot be started until the machine and standpipe have been correctly prepared.

The control rod and actuator servicing machine

The control rod and actuator servicing machine (CRASM) is designed to remove for servicing, the actuators, control rods, gags and fixed absorbers, and to replace the spares. The control rod actuators are winches about 15-in. dia. and 12-ft. long (including the shielding plug) and they weigh 15-cwt. They are in the CO_2 pressure system, and are secured in the biological shield in specially-shaped standpipes. The method of securing them is by screwed rings which are turned by operating a motor and gear ring, known as the actuator clamping machine. This clamping machine must be attached to the actuator when it is being removed from or replaced in the standpipe. The CRASM consists of a magazine section containing grabs and their winding gear, and a support, or skirt section complete with various tools by means of which the actuator can be separated from, or connected to its control rod. The skirt section is also used with the "visual observation and recovery equipment" when necessary. Both sections can withstand, either separately or together, the gas pressure in the reactor. The magazine section is about 40-ft. high and 5-ft. dia. and, together with its shielding, weighs 85-tons. It consists of a pressure-vessel containing four magazines and associated equipment. Around the pressure-vessel is fitted shielding in a structure by which the main crane can lift the complete unit. A ball race of 90-in. dia., on which the pressure-vessel and the major portion of the shielding can be rotated in the vertical plane, is situated in the shielding structure. One of the four magazines is for a "clean" (uncontaminated) actuator; one for a "dirty" (radioactive) actuator; one for a "clean" control rod, and one for a "dirty" control rod. Each magazine contains its appropriate grab which is raised or lowered by an independent set of winding gear.

What is claimed to be the world's largest single-unit distillation plant, and capable of producing 1,200,000 gal./day of fresh water from sea water (or a sufficient water supply to meet the requirements of a town of about 25,000 people), is being built by **Buckley and Taylor Limited,** Castle Iron Works, Oldham (a member of the Brightside Group of Companies). This fact was announced recently when Mr. F. J. Erroll, M.P., Minister of State, Board of Trade, toured the company's works, and was shown a scale model of the plant. When completed, the plant will be installed at an oil refinery at Cardon, Venezuela, to the order of the Compania Shell de Venezuela Limited. It is stated to be a new type of distillation plant, manufactured under the name of "Aquaflash," and its output will be approximately one-tenth of the world's present land-based sea water distillation capacity. The plant will occupy a space roughly 165-ft. long by 20-ft. wide by 16-ft. high. Its eight condensers, each weighing about 14-tons, will contain approximately 83 miles of condenser tubes. Sea-water will be fed into the plant at the rate of over 5,000,000-lb./hr., and the pumps needed to circulate the water in the plant will need more than 500 h.p. to drive them. The basic principle of the process is that heated sea-water is sprayed into a vessel which is maintained at a low pressure. The water boils instantly, and the steam "flashes" off.

* * *

Associated Electrical Industries Export Limited has been awarded the contract for two 300-MW steam turbine-generator sets for Lakeview power station on the shore of Lake Ontario, near Toronto. The order has been placed by the Hydro-Electric Power Commission of Ontario; the first machine is to be commissioned in September, 1963, and the second a year later. Certain items in connection with the generators will be manufactured in Canada to A.E.I. designs, principally by the Canadian General Electric Co. Ltd., the steam turbines being wholly manufactured by A.E.I. The sets will comprise 3,600 r.p.m. tandem-compound turbines and direct-coupled a.c. generators; generation will be three-phase, 60 c/s at 18,000 V 0.85 p.f., and the generator exciters will be motor-driven. The turbines will be four-cylinder machines designed for steam inlet conditions of 2,350 lb./sq. in., 1,000 deg. F. at the turbine stop-valve. Before entry into the intermediate-pressure cylinder, the steam will be passed back to the boiler and reheated to give a temperature of 1,000 deg. F. at the intermediate-pressure inlet. After passing through twin double-flow low-pressure cylinders the steam will exhaust to the condensers at a vacuum of 29 in. Hg. The generators, of caged-core construction, will incorporate rotor cooling by hydrogen at 30 lb./sq. in., together with the A.E.I. system of direct-water-cooled stator windings.

The Sampling of Coke and Coal

By A. C. DUNNINGHAM, D.Sc., F.Inst.F.

AFTER more than ten years of work by the sub-committee appointed to revise the 1942 edition of this British Standard, a new edition has now been published (B.S. 1017, Parts 1 and 2, 1960). This consists of two separate volumes, one for coal (Part 1) and one for coke (Part 2), each consisting of well over 100 pages, which together replace the single volume of 1942 which covered the sampling of both coal and coke, within approximately 50 pages. Not only have all the details of sampling and reduction been most carefully revised, but a new conception of "duplicate sampling" has been introduced as a check on accuracy. The recommendations made in this new specification are not only supported by adequate experimental data but also by many pages of statistics which, incidentally, are more or less the same in both volumes, thus providing a complete and independent sampling manual for both coal and coke.

The specification is based fundamentally, like those that preceded it, on the principles laid down in B.S. 403 1930 "Report on the sampling of small coal up to 3 in.," in which it was shown that the accuracy of a sample depends upon the variability of the fuel sampled and upon the number of increments taken to make up the gross sample. It was also shown that there is a close connection between the ash content of a coal and its variability, and that the former can usually be taken as a reasonable measure of variability. More recent work, such as that of Landry (U.S. Bureau of Mines, Bulletin 454), has shown that factors other than ash content may affect variability, although to a much lesser degree; but it has proved impracticable to apply a knowledge of these quantitatively in ordinary practice. Experimental data collected by the revisionary committee in the course of its work, has, however, shown that the variability of individual coals, especially those of high ash content, may be greater than was originally assumed on the basis of their ash content. This has led to a revision of the minimum numbers of increments considered necessary for a given standard of accuracy, although it is difficult to make a direct comparison with earlier specifications because the standards recommended have themselves been changed. In the 1942 edition of B.S. 1017 and in the specifications preceding it, it was laid down that 99 per cent. of the tests should, on the average, fall within the prescribed limits, as, for example, within $\pm$ 1.0 of the true ash content, whereas the new specification requires that only 95 per cent. shall fall within such limits. Three standards of accuracy are recognised in the new specification, the "high" standard requiring that 95 per cent. of the tests shall fall within $\pm$ 0.5 of the true ash content, and the "normal" accuracy, which requires that 95 per cent. shall fall within $\pm$ 1.0 of that figure. In addition, for coals with more than 10 per cent. ash, a third standard of accuracy is recognised such that, in 95 per cent. of the tests, the error shall not exceed $\pm$ one-tenth of the true ash content.

Sampling is considered under two headings. The sampling of isolated consignments necessitates a procedure based only on a knowledge of presumed ash content, size grading and method of preparation of the coal. Otherwise its sampling characteristics are unknown, and since, by definition, there is only one consignment, the experience gained in sampling it cannot be applied to subsequent consignments. On the other hand, when a coal is received and sampled regularly the experience gained may be used to improve the accuracy in subsequent sampling.

When regular sampling of successive consignments of the same coal is carried out, the main interest often lies more in the average of a number of samples over a period, than in an individual sample. Such is the case when the samples are used as the basis for calculating periodic boiler efficiencies, when the average of all samples taken during the period is used. The accuracy of the period average will then depend not only upon the variability of the coal itself but upon the number of samples averaged, and a somewhat lower standard of accuracy may then be permissible for individual samples.

Regular sampling may be "continuous" or "intermittent." In the former, all the units of coal received are sampled, whilst in the latter only some of the units are sampled. A "unit" of coal signifies the quantity sampled, such as a wagon, a consignment or the amount passing to a plant during each shift or other selected period. In continuous sampling it is only necessary to take into account the variability of the coal itself in fixing the number of increments, but in intermittent sampling, in which only some of the wagons or consignments are sampled, or when sampling does not take place on every shift, the variability as between the units themselves must also be considered.

TABLE I

Minimum number of increments to be taken when sampling an isolated consignment by means of six sub-samples.

(A) Washed coals (under 3 in.)

Accuracy	Ash (per cent.)		
	Less than 5	5 to 10	Over 10
High	6 x 4 = 24	6 x 14 = 84	6 x 30 = 180
Normal	6 x 1 = 12	6 x 4 = 24	6 x 8 = 48
Tenth	—	—	6 x 4 = 24

(B) Uncleaned coals including dry cleaned and part-washed (under 3 in.)

Accuracy	Ash (per cent.)			
	Less than 5	5 to 10	10 to 15	Over 15
High ...	6 x 12 = 72	6 x 28 = 168	6 x 60 = 360	6 x 110 = 660
Normal ...	6 x 3 = 18	6 x 8 = 48	6 x 16 = 96	6 x 32 = 192
Tenth ...	—	—	6 x 8 = 48	6 x 8 = 48

The minimum numbers of increments to be taken in the sampling of an "isolated" consignment for the three standards of accuracy mentioned above are given in Tables Nos. 1 and 2, reproduced from the specification. It should be noted that it is recommended that samples shall be taken in the form of six sub-samples, so as to

reduce the effect of errors of sample preparation and also the number of individual increments necessary for the required degree of accuracy. These replicate sub-samples are spread over the whole consignment by putting increments successively into different containers. The analyses of these sub-samples may be used to check the accuracy of the sampling.

The number of increments is specified both for sampling by one gross sample and by six sub-samples. It will also be noted that the tables divide coals into two groups, "washed" and "untreated," and that the latter require more increments than the former, not only because they have a higher ash content, but also because washed coals are better mixed and, therefore, more uniform.

TABLE 2
Minimum number of increments to be taken when sampling an isolated consignment by means of one gross sample

(A) Washed coals (under 3 in.)

Accuracy	Ash (per cent.)		
	Less than 5	5 to 10	Over 10
High	32	128	270
Normal	12	24	50
Tenth	—	—	24

(B) Uncleaned coals including dry cleaned and part washed coals (under 3 in.)

Accuracy	Ash (per cent.)			
	Less than 5	5 to 10	10 to 15	Over 15
High ...	100	240	540	*
Normal ...	20	48	100	200
Tenth ...	—	—	48	48

*For these coals it is necessary to take a number of sub-samples.

Owing to the varying requirements of regular sampling, the specification does not give the number of increments to be taken, either for continuous or intermittent sampling. Instead, the specification gives a method by which the accuracy can be checked and adjusted when necessary by means of "duplicate" sampling, in which two sub-samples are obtained by placing alternate increments into two containers, these sub-samples subsequently being analysed separately.

The difference between the duplicates is an indication of the accuracy attained, and when 10 such sets of duplicate samples have been taken, the differences may be used to find out whether too many or two few increments are being taken for the required accuracy and a correction can, if necessary, be made. Too few increments means a lower standard of accuracy, and too many means unnecessary sampling costs. It is recommended that duplicate sampling shall be used to check accuracy in all cases of regular sampling. Obviously it cannot be used in connection with the sampling of isolated consignments, because no further sampling of the same coal takes place.

The taking of duplicate samples is easy, and should not entail more labour and time than is required for taking a single gross sample. The preparation and analysis of two samples instead of one must, however, be more costly. Once ten sets of duplicates, obtained by sampling ten units of the same coal, are available, the check on accuracy, that is, on the number of increments required, can be made with the assistance of tables given in the specification. The use of these tables, however, is more or less "rule of thumb," and considerable care will be necessary in order to avoid errors, especially if the user has no clear idea of the theory behind them. The statistical basis for these tables is, however, set out clearly in an appendix which will be of considerable value to those with some knowledge of statistics, but may mean little to those without such knowledge, which, however, is not necessary for a proper use of the tables. Large coal users with qualified staff will be able to adjust their sampling procedures to meet any requirements as regards accuracy, and whilst many small users may be content to carry out sampling by rule without any effort to check its accuracy, such checking is still within their capacity if they follow carefully the rules laid down in the specification, which with a little practice should present no difficulty. Examples are given in the text of the specification.

Once the gross sample has been taken, great care should be exercised in reducing it to a laboratory sample. This involves three distinct operations. Particle size has to be reduced by crushing or grinding, the product has to be mixed and finally sub-divided to give the sample for analysis, which weighs about $\frac{1}{2}$ lb. The general principles of sample reduction and sub-division remain as in former specifications, but mechanical appliances for carrying them out have been improved and developed considerably during recent years and are described in detail in the new specification. Such processes are usually a great advance on hand operation. Formerly the gross sample was crushed and sub-divided in stages, the coal being progressively reduced in size before each sub-division. A large variety of mills is now available, including high speed beater types, which can reduce the whole of a gross sample to a powder, rapidly and in one stage

The specification now recommends that sample preparation shall be carried out in two stages. In the first, the whole gross sample is passed through the mill and crushed as close as possible to $\frac{1}{16}$ in. so as to reduce the weight of sample carried forward to the second stage. A crusher which gives a product greater than $\frac{1}{4}$ in. in size should not be used. After crushing, the sample is divided to the appropriate weight as given in Table No. 3.

TABLE 3
Minimum weight of sample to be taken after crushing

Top size of coal (square mesh)	Weight of sample				
	Average ash (per cent.)				
	0-5	5-10	10-15	15-20	Over 20
in.	lb.	lb.	lb.	lb.	lb.
1	35	90	150	200	250
½	14	40	65	85	105
¼	4	12	20	25	30
⅛	2	5	8	11	13
1/10	½	1½	2½	3½	4
☆	½	1	1	1½	2
14 B.S.	½	1	1	1½	2
36 B.S.	½	½	½	1	1
72 B.S.	½	½	½	½	½

Table 3 shows that $\frac{1}{16}$ in. coal can be reduced to $\frac{1}{2}$ lb. to 2 lb. according to the ash content. The second stage in sample preparation consists in crushing this sample to such a size that a sample of $\frac{1}{2}$ lb. can be extracted. This is done by means of a mechanical sample divider, or by riffling after mixing. A simple form of mixer is described. The final sample must be reduced to 72 B.S. The procedure may be somewhat modified according to the degree of accuracy required.

Mechanical sample division is to be preferred to the use of hand-operated riffles or other such appliances, because it is quicker and more convenient in operation,

and because it eliminates the element of human fallibility which can be a serious source of error in sample preparation. Several types of mechanical divider are described, including the rotary sample divider, the double cone divider and the moving flap divider. These are considered more reliable than the riffle divider, which, however, may be used for first-stage sample dividing and, with certain precautions, for later stages.

The actual procedure for taking the sample requires careful consideration in order to avoid bias and ensure that the sample is representative of all the coal sampled. Sampling is best carried out from a moving stream of coal as, for instance, from a conveyor or chute.

Mechanical samplers have their advantages, but they should be tested for bias before use. Various sampling scoops and ladles are described and illustrated. The problem of accurate sampling from wagons before discharge or during tipping has not yet been solved and this method is not recommended although it may sometimes be unavoidable. For smalls of less than ¾ in. upper size, samples may be taken from wagons by means of augers and probes, but for larger sizes sampling from holes dug into the coal at appropriate points remains the only method of direct wagon sampling, which should be avoided whenever possible.

The sampling of large coal, that is, with a top size over 3 in., and with smalls, usually under 2 in. removed involves large gross samples and still presents considerable difficulty. The number of increments required varies with the ash content and is given in Table 4. The principle of duplicate sampling is applicable to large coal.

TABLE 4
Minimum number of increments required in sampling large coal

Nominal size of increment lb.	Number of increments			
	Average ash (per cent.)			
	Less than 4	4 to 6	6 to 8	Over 8
10	30	84	114	200
50	12	24	40	40

As before, a special section of the specification deals with the collection and preparation of the moisture sample. This does not differ materially from that in the 1942 specification. It is, however, set out more clearly, and diagrammatic tables illustrate the methods of obtaining and preparing separate moisture samples, and samples taken from the gross sample. These tables are very clear and useful.

B.S. 1017, 1942, superseded all previous specifications except B.S. 735, 1937, which dealt with sampling for plant efficiencies and acceptance tests, which require a high degree of accuracy. Such sampling is now dealt with in a special section of the revised specification which, therefore, replaces and supersedes all other specifications for sampling coal.

From what has already been said above, it will be evident that B.S. 1017, Part 1, 1959, is, in effect, a textbook on coal sampling. including the statistics on which it is based, and at first sight the reader may well wonder whether he will be able to find his way about in such a comprehensive document and draw up the procedure required by his own particular conditions. This doubt may have occurred also to those who wrote the specification, for they have added diagrammatic tables outlining the procedures for sampling isolated consignments, and for regular sampling, together with reference to the sections dealing with each stage of sampling and preparation. These are admirably clear, and are accompanied by tables of minimum numbers of increments required to build up the gross sample, together with minimum weights to be taken during the process of sub-division—thus avoiding repeated reference to the text.

The committee responsible for this revised specification are to be congratulated upon producing a document which is not only complete and comprehensive, but which should be readily understandable by all those who wish to use it and are prepared to study it carefully. It should remain the standard work on coal sampling for many years to come.

The Sampling of Coke. B.S. 1070 Part 2, 1960

The sampling of coke is dealt with in an entirely separate volume (Part 2) which contains considerable repetition of material already given in Part 1 dealing with coal. This is particularly so with regard to definitions, statistical theory and the exposition of duplicate sampling as applied to solid fuels. This repetition, however, makes each volume complete in itself, with the statistical material introduced in each case at the most appropriate points.

Unlike coal, of which the most variable property is the ash content, coke exhibits most variability in its moisture content, on which the necessary number of increments is based. Great care must be taken in collecting and preparing samples of coke to ensure that they are representative of its moisture content, because some of this moisture is easily lost by evaporation during handling.

For the purpose of sampling, coke is divided into the following four classes:

(1) Large or graded gas cokes from which breeze has been removed.
(2) Large or graded oven cokes from which breeze has been removed.
(3) Gas or oven cokes from which breeze has not been removed.
(4) Breeze.

Since the variability of the moisture in these four classes is different, the number of increments required also varies as shown by the following Table 5 which applies to an accuracy of ± 1.0 per cent. for 95 per cent. of the tests.

TABLE 5
Number of increments for accuracy of ± 1.0 per cent.

Class	Moisture	Increments
1	5 per cent or less	32
	Over 5 per cent.	48
2	5 per cent. or less	48
	3-5 per cent	72
	Over 5 per cent.	108
3	3 per cent. or less	100
	3-5 per cent.	150
	Over 5 per cent.	225
4	All moisture contents	16

A full description of the methods available for taking the sample is given, and of the scoops which may be used for the purpose. Owing to the size of coke, increments as large as 15 lb. may sometimes be required and the gross samples are then correspondingly large. The preparation

and reduction of the sample for analysis requires great care to avoid loss of moisture during the process and the use of both hand and mechanical methods of crushing and sub-division is described, and full details are given of the precautions necessary to avoid loss of moisture from the sample. As in the case of coal, a diagrammatic table sets out the procedure, with references to the appropriate sections of the specification.

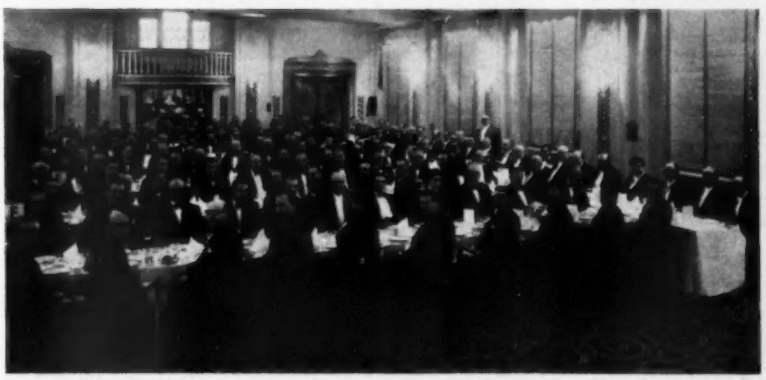
The new specification, whilst based on the same principles as that of 1942, embodies the results of a large amount of experimental work carried out, particularly by the Joint Coke Consultative Committee, to improve the technique for collecting the sample. As in the case of coal, the principle of duplicate sampling is applied for determining and maintaining the required degree of accuracy, so as to ensure that 95 per cent. of the tests fall within the specified limits, such as ± 1.0 per cent., of the true moisture value. These limits may, of course, be fixed at any value required by the actual circumstances.

The specification also gives the procedure for preparing coke for general analysis, in which it is important to avoid contamination from the crushing mechanism, and also for the determination of physical properties such as shatter and abrasion indices. An "outline" guide draws attention to all the points which have to be considered when a sampling scheme is instituted. Finally, an appendix sets out the experimental data upon which the specification is based. As in the case of Part 1, a careful reading of the specification will show that it is less complicated and more readily understood than would appear at first sight.

These notes form only a general review of the specifications for sampling coal and coke, and although certain tables giving minimum numbers of increments and other data have been quoted, they should not be used as a guide to sampling except in connection with the specifications themselves, in which full details of procedure are given.

The Institution of Plant Engineers

The eighth annual dinner of the Institution of Plant Engineers was held at the Connaught Rooms, London, on February 19th. The principal guest speakers were:—Sir William Robson-Brown, M.P., and Major General Sir Henry Sugden, K.B.E., C.B., D.S.O. (Engineer-in-Chief, The War Office). Proposing the toast of "The Institution," Sir William Robson-Brown said that Parliament was very much concerned with maintenance, as was the plant engineer. British industry would never be as secure and progressive as it should be, until the engineer was given his right and proper place in management. Sir William felt that all too often, the accountant was given preference over the engineer when it came to the appointment of directors of companies.



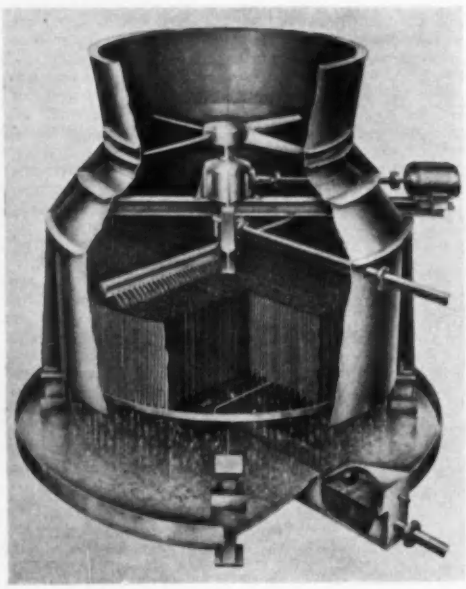
Assembly at the annual dinner of The Institution of Plant Engineers in London, on February 19th, 1960.

Plant engineers were responsible for maintaining and improving plant so that the highest possible level of efficiency was reached; and this was, of course, vital to the national interest. Sir William also expressed concern at the continually growing costs and the growing wage demands which faced the country at present. Everything rested precariously on the attitude of the unions. He stressed the importance of the secure value of money, and said that he was only interested in a stable currency. "The trouble," said Sir William, "is that since the war, paper money has dominated our economy." Referring to his recent suggestion in Parliament that there should be an urgent and immediate enquiry into the structure and operation of the British Railways system, Sir William said that "the root of the problem was probably the lack of harmony between road transport and the railways. What was needed was a proper valuation of the potential of the railways with regard to passengers and freight." Sir William concluded by paying tribute to the important work in the field of extra-mural engineering education which was being undertaken by the Institution of Plant Engineers. In his response, the President, Mr. K. F. Dormer, M.I.Plant E., traced the development of the Institution from its early days in 1946, when a small number of plant engineers decided to meet regularly to discuss their technical problems. Those meetings proved to be so successful that it was decided to continue them through the medium of an incorporated body under the title of "Incorporated Plant Engineers." Thereafter, expansion was rapid, and a significant stage was reached last year when the Board of Trade authorised the designation "The Institution of Plant Engineers." The present membership of more than 4,000 was spread over 18 branches in the United Kingdom, and was an achievement of which all members could be proud. The President went on to mention the many different fields of engineering in which members were engaged, and said that the Institution's membership requirements were framed so that the engineer without academic background was not necessarily excluded from membership. He pointed out that the rapidly expanding mechanisation and the complexity of industrial installations, together with the high cost of new equipment, were enlarging the responsibilities of the works and plant engineer. The most efficient and effective use of plant and machinery was essential if production was to be maintained at the highest possible level, and it was therefore vital to the country's industrial effort that everything possible should be done to keep our engineers abreast of modern methods and techniques. It was here that the Institution could claim to have made an outstanding contribution to industrial education in Britain by means of its comprehensive refresher courses for senior works and plant engineers, and which are held in most of the principal industrial centres, and designed not only to increase knowledge, but to make better use of existing knowledge.

The toast to the guests was proposed by Mr. E. C. Stevens, M.A., B.Sc. Tech., A.T.I., M.I. Plant E., president-elect, who, in paying tribute to the many individual distinguished guests, made particular mention of Major General Sir Henry Sugden, who had within the last few days received the accolade of Knighthood in recognition of his services to the country.

Multi-Channel Cooling Towers

A NEW design of cooling tower which is claimed to weigh less than half that of a conventional pattern tower of similar capacity has been developed by Thermotank Limited, Helen Street, Glasgow. The saving in weight, and in size, has been achieved largely by the use of an entirely new form of fill material in which the water is cooled by a counter-current of air as it passes through very closely-spaced elements. This fill material has been developed by Carl Munters of Sweden, and consists of a plastic impregnated wood cellulose, which combines high resistance to deterioration under severe operating conditions, with excellent qualities of water absorption. As well as the new type of fill, the manufacturers have introduced several novel features in both the design and construction. Fabricated rolled-steel sections, treated against corrosion, form the structure of the tower, and the casing is of heavy-gauge galvanised sheets, with side panels which can be removed to allow for easy maintenance. The tower, which is circular in shape, and designed to withstand a wind force of 30-lb.



Cut-away view of the Thermotank cooling tower showing arrangement of fill and water distribution.

per square foot, contains a top-mounted axial-flow fan which draws the surrounding air up through it from the bottom, and this cooling-air passes through the vertical channels in the honeycomb structure of the fill. This is in the form of thin sheets—alternate flat and corrugated sheets being joined together to form a compact fill having almost tubular passages, and providing a large area for heat transfer purposes while permitting the maximum unrestricted free area for the passage of air per unit volume, since the high wettability of the material ensures that the water adheres to the walls of the channels.

As the rigid units forming the fill require only a very light supporting structure at the base, the entire internal area of the tower can, therefore, be occupied by the fill without need for bracings. It is estimated that for the same cooling effect, the fill occupies only about one-fifth of the space taken up by the conventional wooden slat form of construction. Two grades of fill having two sizes of channel are made, the larger having a spacing of a little more than $\frac{1}{4}$-in.

Thermotank International Products Division have an exclusive licence to apply this fill material in the United Kingdom and in South Africa, while they also have licence arrangements in Australia and New Zealand. as well as many other territories including Iran, Kuwait, Bahrein, Kenya and the Central African Federation. The water to be cooled passes through a flanged inlet pipe to a central hub, to which is attached a bearing assembly supporting a rotating header pipe. The plain thrust and journal bearings are of plastic-impregnated fabric base material having good wet and dry running properties. The header pipe consists of one or more arms in which a row of holes is drilled in such a form that the water leaves the tube horizontally, or in a slightly downward direction. The header rotates under the reaction of the jets and provides a curtain of water which moves round over the top of the fill. The holes are graduated along the length of the arms, in order to give uniform distribution at all points on the top surface of the fill. The header operates at a very low static pressure, and thus gives large water droplets so that the air can flow through the fill at a high velocity without excessive water entrainment. The water flows down the walls of the channels in a thin continuous film, and since this is continuously maintained, any foreign matter remains in suspension and is drained away so there is no possibility of the channels becoming choked. To prevent any possible accumulation of water at the base of the fill, with its resultant restriction of the flow of air, the lower face of the fill is serrated. This breaks the capillary bond and allows the water to run off the tips of the serrations into a catchment tray. The latter is of heavy-gauge steel-plate and drains into a local sump which is fitted with a pump suction connection, suction screen drains and overflow connections, and a make-up water float valve assembly. A series of capacity trials carried out by the company has established the relationship between cooling effect, air flow, water flow, etc., and the data so acquired, have determined the dimensions and capacity of the range of these cooling towers. The trials also confirmed that the new fill does enable substantial reductions to be made in both volume and weight in comparison with existing systems. In particular, the resistance of the fill material to acids at normal and elevated temperatures was investigated, together with questions of wet-strength and shrinkage. It appears that the material successfully withstood all these stringent tests. A limited number of cooling towers were built and installed in suitable plant, most of them in locations where the water has a high content of salts. Accelerated tests, equivalent to about 12 years of normal operation, were also performed with

cooling-tower fills in specially-built apparatus where the material was thoroughly soaked for 2 min. and then dried with hot air; this cycle being repeated every half-hour. In these tests, fresh water was fed to the tower without any steps being taken to reduce the concentration of salts in the water.

The powerful inhibiting action of the special impregnation agents in the fill material on bacteria and fungi was clearly shown by the negligible quantities of sludge formed in the fill, although parts of the tower casings were covered with algae on certain sites. At present, the towers are being produced in 12 graduated sizes, of which the largest can deal with 90,000 gal./hr. of water at 87 deg. F. on, and 75 deg. F. off, and a wet-bulb temperature of 68 deg. F. The size of this unit is given as being 20-ft. dia. by 12-ft. high, and weighing 9.5 tons. The comparative figures for a conventional cross-flow induced-draught tower are said to be, base 32-ft. 9-in. by 20-ft., height 11-ft., and weight 27 tons, while those for a vertical induced-draught tower are quoted as: base 26-ft. 3-in. by 18-ft. 3-in., height 27-ft. and weight 29.5 tons.

For the drive assembly, direct motor-driven fans are used where possible, but gear and belt-driven fans are also offered. The motors are of the totally-enclosed, weatherproof type, and are fan-cooled when fitted outside the casing. Gear units, when fitted, would have substantial cases manufactured from cast-iron, the units being designed specifically for cooling-tower service.

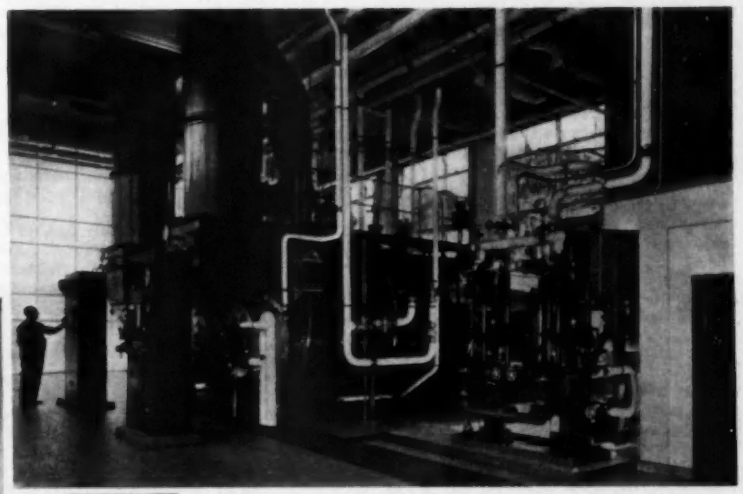
New Boiler Plant for Ilford Limited

IN order to achieve economies through the integration of manufacturing processes, Ilford Limited, the well-known suppliers of photographic materials and equipment, have closed their factory at Park Royal, London N.W.10, and the work originally undertaken there is now carried out in a recently completed extension to an existing Ilford factory at Mobberley, Cheshire.

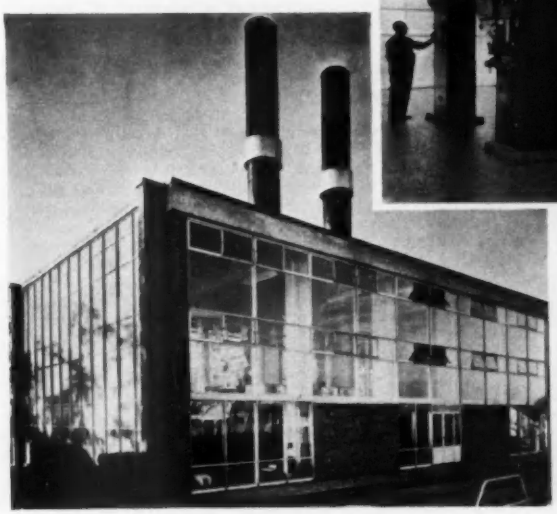
Two oil-fired boilers, supplied by Davey, Paxman & Co. Ltd., have been installed to provide steam for space-heating purposes, in the new extension. Two forms of heating are used—continuous strip reflector steam-heaters in the stock and dispatch areas, and a low-pressure hot-water system, served by steam calorifiers, in the remaining factory areas, offices and cloakrooms.

The boiler house is 92-ft. by 45-ft., by 25-ft. high, and is of reinforced-concrete frame and curtain-wall construction, with large areas of glass on the front and side elevations. It is large enough to accommodate a third boiler of a similar type and capacity, should this be required in the future. The roof level within the boiler house was determined by the height of two 22,000-gal. capacity oil-storage tanks, which are contained in a brick-built enclosure integral with the building—a feature which provides a bund, and in addition, makes possible the elimination of thermal insulation, around the tanks. The boiler house also contains a hotwell condensate recovery tank of approximately 9,000-gal. capacity.

(Right). Two double-pass high-velocity "Ultrasonic" boilers were supplied by Davey, Paxman & Co. Ltd., and installed in the Mobberley works of Ilford Limited. Each unit is designed to operate at 10,000 lb./hr. and 100 lb./sq. in.



(Below). The boiler house is of reinforced-concrete frame and curtain wall construction, with large areas of glass on the front and side elevations.



The boilers installed are of the Paxman double-pass, high-velocity "Ultranomic" type, of all-welded construction, 9-ft. dia. by 20-ft. 6-in. overall length, and designed for a normal duty of 10,000 lb./hr. at 100 lb./sq. in. from and at 212 deg. F. Oil-burners arranged for gas/electric ignition, and of the rotary-cup type, were supplied by Hamworthy Engineering Co. Ltd. These are fully-modulating, and arranged to operate in con-

junction with instrument equipment supplied by Electroflo Meters Co. Ltd.

The instruments provided include steam pressure and flow indicators, draught indicators, pyrometers for the measurement of combustion-chamber and outlet temperatures, and a James Gordon & Co. Ltd. Mono CO_2 recorder. Both automatic on/off, and manually-controlled switchgear is provided for the power supply to the boiler auxiliaries.

Duplicate feed pumps, each of which is capable of serving the two boilers, were supplied by G. & J. Weir Limited, who also provided water-circulators of the "Hydrokineter"-type, and "Steadiflow" meters and feedwater regulators. "Hilo" water-alarm equipment was supplied by Ronald Trist & Co. Ltd. Plant supplied by Neckar Water Softeners Limited has been installed to treat the boiler make-up water, and is designed to handle a maximum flow of 2,500 gal./hr. This unit is of the base-exchange type, with a capacity between regeneration of 30,000-gal., and is provided with conditioning equipment with a capacity of 800/900-gal./hr. A feedwater measurement and regulating set is provided. This is of the V-notch type, supplied by The Lea Recorder Co. Ltd.

The oil storage tanks are fitted with both steam and electric heaters, and the fuel is delivered to the boilers via two electrically-driven gear pumps, and Duncan Low Limited, oil-heaters, and filter-sets.

TEMPERATURE MEASUREMENT AND CONTROL EQUIPMENT EXHIBITION

A small but comprehensive exhibition of instruments manufactured by Negretti & Zambra Limited for temperature measurement and control was staged recently at the Royal Society of Arts, London, following a successful tour of a number of important centres throughout the country. New equipment exhibited included a range of electrical temperature-measuring and controlling instruments known as the Aetec series. Thermo-electric pyrometers in the series are suitable for temperatures up to 3,100 deg. F., and electrical resistance thermometers for temperatures between − 330 deg. F. and + 1,100 deg. F. Both units incorporate a newly developed galvanometer, designed to maintain a high degree of accuracy under the most arduous operating conditions. Multi-point indication is possible with both types of instrument. The pyrometers can be equipped with a built-in switch to provide measurement at up to five points, and the thermometers with the same facility for measurement at four points. With an external switch-box the single-point version of either instrument can provide measurement at up to 24 points. The size of the instruments has been standardised with an 8-in. scale, so that they can be easily read, while not taking up unnecessary space on an instrument panel. Aetec controlling thermo-electric pyrometers also are suitable for the control of temperatures of industrial processes up to a maximum of 3,100 deg. F. Closeness of control is ensured by the use of the new design of galvanometer, as incorporated in the instruments described above, and secondly by a control mechanism with a rapid response so that corrective action is quickly applied. The 8-in. scale is also used for this instrument. Further new equipment included two air-operated controllers which are small but powerful, and provide improved local control. They are the "On-Line" receiving controller for controlling a number of physical conditions such as temperature, pressure or vacuum, humidity, liquid-level, specific gravity of liquids, etc.; and the "On-Plant" temperature controller, incorporating a mercury-in-steel measuring system. The company have also re-designed and improved their air-operated temperature transmitters. A section of the exhibition which proved to be most popular was that featuring the history of the liquid-in-glass thermometer, the subject matter for which was taken from a recent Negretti & Zambra publication, "A Story of Temperature Measurement."

John Thompson Limited, Wolverhampton, recently completed negotiations for the investment of £31,000 in S.A. Astar. A member of the Astarsa Group, of Buenos Aires, Astar will now be available to manufacture parts for John Thompson products in Argentina. For this purpose, the company will work in close co-operation with **Mr. R. Horlock,** who, in November, 1959, was appointed from Wolverhampton to manage John Thompson Group's new branch office in Buenos Aires. Many of the Wolverhampton company's manufacturing techniques will be incorporated in Astar's production, for which purpose new machinery is to be installed. New rolls capable of rolling steel plates of thickness up to 70 mm. (2¾-in.) will greatly increase the productive capacity of the Astar factory. By the enlarging of production resources, Astar will be fully-equipped to supply plant for the important development taking place in the oil and petro-chemical industries, now that Argentina has become self-supporting for her oil requirements. Throughout the negotiations culminating in the present agreement between Astar and John Thompson, the British company was represented by its deputy-chairman and joint managing director, Mr. J. H. N. Thompson.

* * *

Fluidrive Engineering Co. Ltd., whose products are used in almost every major industry at home and overseas, has first-class facilities for apprentice training for both student and craft apprentices. It is, in fact, the policy of the company as far as possible to select and train its personnel for all departments. There are at present about 60 student and craft apprentices at the Isleworth, and the Bracknell Works, the Apprentice School being at the latter. Good board and lodging is available for apprentices whose homes are outside the works areas, and the company subsidises the weekly payments. Great importance is attached to technical study, and with the assistance of day release classes, a considerable proportion of apprentices attain the Ordinary National and Higher National Certificates. The minimum qualification for applicants for student apprenticeships is a G.C.E. at "O" level in four subjects including English, Mathematics and Engineering Science (not Chemistry). In addition, a limited number of sandwich courses are made available to candidates with the necessary qualifications, the course being divided into alternate six-monthly periods at the Works and at a Technical College, the expense of the latter being borne by the company. The company has, at the present time, vacancies for student and craft apprentices, and welcomes applications from boys of 15 to 17½ who are keen to enter the engineering industry. Application forms and particulars will be sent on request to:—The Apprentice Supervisor, Fluidrive Engineering Co. Ltd., Fluidrive Works, Isleworth, Middlesex.

* * *

The Clean Air Exhibition organised by the **National Society for Clean Air** will, it is anticipated, be an even bigger success this year. To be held in Harrogate's new Exhibition Hall from October 4th to 7th, it will cover 10,000 sq. ft. The exhibition is to run in conjunction with the society's conference, which is expected to attract more than 1,000 delegates. They will include councillors and officers of local authorities most concerned with putting the Clean Air Act into force (especially in "black areas"), industrialists, fuel technologists, and officials of Government Departments. In 1958, a small but successful exhibition was held at Llandudno in the same hall as the conference. Last year, a larger and even more successful exhibition was held at Seymour Hall, London, at the same time as the society's Diamond Jubilee International Conference. The promise of success shown by this year's exhibition confirms the society's view that they are recognised as useful by all concerned. Over 30 firms and organisations will be showing every type of smokeless fuel, boiler house and fuel efficiency equipment, devices to trap grit, dust and fumes, and domestic heating appliances suitable for use in smoke control areas. Any firm wishing to secure a place is advised to contact the society's Exhibitions Officer at Palace Chambers, Bridge Street, London, S.W.1 (Trafalgar 6838) as soon as possible.

Northern Works of Mullard Limited

This description of the two main works of Mullard Ltd. in Lancashire is of interest not only as regards the processes involved in the manufacture of television tubes and valves, but in view of the extensive use of town gas.

TWO of the main manufacturing plants of the Mullard Group have been established in Lancashire, at Blackburn and Simonstone, and we were recently given the opportunity to visit these factories to see the processes involved in the large-scale manufacture of television tubes, and valves for television and radio sets. Other Mullard factories in Lancashire are at Southport, Fleetwood and Lytham St. Annes.

The Blackburn plant is responsible for the majority of the Group's production of radio and television valves, with large sections of the works being devoted to the manufacture of fine tungsten and molybdenum wire, glass and components. In the manufacture of valves, apart from the mica spacers and the nickel used for some electrodes, all the components for the many different types produced are made within the plant. The basic components are:—the electrodes, comprising heater cathode, anode and, excepting diodes, one or more grids; the glass envelope and base; the internal supporting members, mica spacers and insulators. The electrodes are assembled into a "cage," ready to be mounted on the base—a small disc of glass holding the connecting pins by which the valve plugs-in to the valveholder, and a corresponding number of wires to which the various electrodes are connected. Joining the stiff metal pins and the thinner connecting wires is a third length of wire which has the same overall coefficient of expansion as the glass, and which, therefore, ensures a perfect air-tight seal where the wires pass through the glass.

The machines on which the bases are made, automatically feed the correct number of tri-metal connecting wires into a jig. A collar of glass is placed around the wires and the whole assembly is revolved while gas flames soften the glass collar, and the machine gently presses it into shape around the centre sections of the tri-metal wires. Special machines then cut the connecting wires into the right lengths and bond them to the exact positions for the electrodes to be welded to them.

The two 100-ft. long Lehr furnaces—the largest single gas-consuming units in the Simonstone factory. The normal load for each furnace is 4,000 cu. ft./hr.

Once the electrode cage has been joined to the base, the assembly is sealed into its glass envelope and air is evacuated to form the vacuum necessary to the operation of the valve. Gas-jets are employed to soften the glass at the junction of the base and the envelope before the sealing machine automatically applies the correct pressure to the joint. Gas jets are also used for "pinching off" the pumping stem once the air has been removed. While the valve is being pumped, the metal components inside are heated by induced high-frequency currents to "drive out" any gases which may have been absorbed during manufacture. An electric current is then passed through the heater to reduce the cathode coating to oxide, thus forming the electron emitting surface, and induced heat is again used to absorb the last traces of gas.

When the valve has been removed from the machine it is operated for a period under controlled conditions, during which time changes occur in the cathode coating, resulting in improved emission. Finally, the valve is put through a succession of exacting tests covering its operating characteristics, emission, vacuum, insulation, etc.

Fine wire

Both tungsten and molybdenum wire are produced by essentially similar processes, the ores first being ground and purified then placed in gas-fired reducing furnaces, operating at temperatures up to 1,652 deg. F., where, in a hydrogen atmosphere they are converted to metal powder. Controlled amounts of special additives are introduced into the pure powder to control its crystal structure and to prevent the finished wire sagging, and the powder is then compressed into bars of convenient size. A sintering process then crystallises the compressed powder into a hard metal, ready to be made into wire.

The first step in the actual wire manufacture is swaging, in which the bars are raised to white heat in gas-fired furnaces, then hammered into successive stages until they take the form of thin rods, which are drawn through a series of progressively smaller dies until they have been reduced to the thickness required. Gas is also used extensively throughout the drawing operations, for heating the wire before it is pulled through the dies, and also in the annealing furnaces through which the wire passes at pre-determined intervals to remove strains.

Glass manufacture

The necessary ingredients for the lead glass required for valve, tube and transistor manufacture are automatically mixed, and then fed into glass melting tanks, which are maintained at a temperature of about 1,500 deg. C. by an oil-fired furnace. From these tanks, the ingredients, now fused into liquid glass, are poured automatically into gas-heated holding and feeding furnaces containing rotating tube-forming machines, and from which the glass is drawn vertically in tubular form. In a room, 25-ft. above the furnace floor, machines grip the tubing and draw up the endless column of hot glass. Operators then cut the tubing into suitable lengths for handling, after which it is cut to size and finished ready to be formed into the various components required.

The manufacture of television tubes

The production of television tubes at Simonstone begins with the component parts of the glass bulb: the cylindrical neck, the flared cone, and the rectangular faceplate. Welding of the neck to the cone is carried out on six automatic rotary machines, each having 12 stations. The two parts are first pre-heated by radiant-cup gas-burners and gas/air burners to bring them to the correct temperature for welding, the actual weld then being made by oxy-coal gas jets. Following this, the bulbs are transferred to a side-sealing machine where a metal (extra high tension) connection is fused into the side of the cone. The region of the seal is pre-heated by radiant-cup burners and gas/air jets, and the seal is made by oxy-coal gas jets. To remove any strains in the glass, the neck and cone assembly is then annealed, a process which also serves to pre-heat the assembly in readiness for welding to the faceplate, which is pre-heated to the same temperature in another oven. Automatic machines weld the faceplate to the neck and cone assembly, gas/air jets being used to pre-heat the two component parts, and cross-fires of oxy-coal gas jets to further raise the temperature of the welding region. The actual weld is accomplished by an electric-arc, struck through gas flames, which brings the edges of the two components up to melting point, when a perfect seal takes place. With the thick glass necessary for television tubes it is essential to heat the two components evenly to avoid strains or cracks, and to ensure this, the gas jets automatically follow the contour of the faceplate keeping a constant distance from the glass as it rotates. The complete bulbs are then annealed to remove any stresses, and then introduced to an extensive overhead conveyor system that runs through the entire plant, and around which all the subsequent processes are planned.

Fluorescent screens are layed on the inside of the tubes by means of specially-designed equipment; they are then dried by infra-red lamps and filtered air, and given internal coatings of lacquer and graphite; the latter to form an electrical connection between the final anode and the e.h.t. connector. A film of aluminium is then layed on the inside of the screen and cone; this acts as a mirror behind the fluorescent screen, increasing the brightness of the picture, while at the same time preventing the screen from being damaged by heavy ions during the tube's working life. The bulbs are next passed slowly through one of two continuously-operated 100-ft. long Lehr furnaces to drive off all moisture and to bake out the unwanted constituents of the various coatings. This baking process also fixes the fluorescent screen firmly to the glass face. The Lehr furnaces are indirectly-heated by gas-fired tubes, and are the largest single gas-consuming units in the factory. They each have a starting consumption of 6,000 cu. ft./hr., and an average hourly running load of 4,000 cu. ft. The bulbs travel through the furnaces on a 12-ft.-wide conveyor belt, the whole process taking some 125-min. The temperature through the furnaces is zoned automatically at seven points, rising from 68 deg. F. through 788 deg. F., and back to 77 deg. F.

Electron guns, which are assembled in a separate part of the factory, and the finished bulbs, are then brought together on rotary sealing machines. These machines seal the gun, which is mounted on a glass base, into the neck of the bulb. Each sealing machine has 12 stations, and employs radiant-cup gas-burners for pre-heating the region of the join, and oxy-coal gas jets for the actual seal. Following this operation, the tubes are transferred to pumping machines where air is withdrawn, and the internal components degassed to create the necessary very high vacuum. The tubes are then connected to power supplies and the internal metal components are bombarded by electrons from the cathode to stabilise its performance.

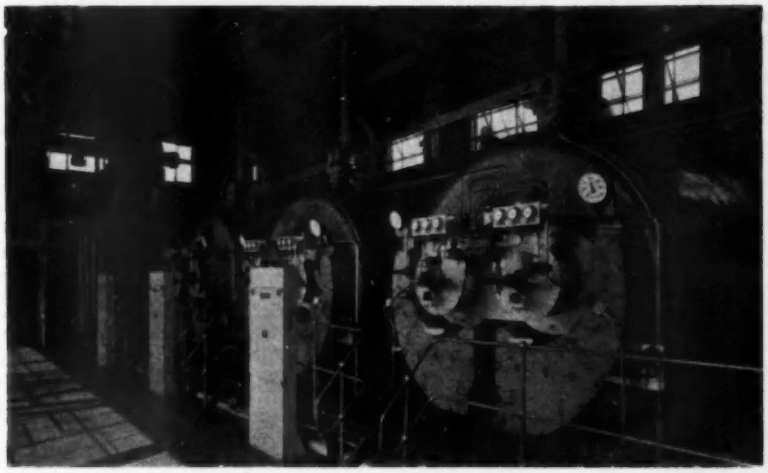
It will be appreciated from the foregoing notes that the various factories of the Mullard Group in Lancashire, which all come within the area of the North Western Gas Board, are extremely large consumers of gas. They do, in fact, use between them 1.8-million therms per annum—an amount sufficient to supply the domestic requirements of a town of some 75,000 people over the same period. During the post-war years there has, of course, been a steady increase in the amount of gas used for industrial purposes—in 1945, 390-million therms were sold to industry, and by the year 1958/59 this had risen to 770-million therms, a figure which represents over 30 per cent. of total gas sales.

Boiler plant at Simonstone

The boiler plant at Simonstone is in keeping with the factory itself, which started production during 1955, and has been described as the most modern of its kind in Europe. Three oil-fired Super Economic boilers, each rated at 9,250 lb./hr., at 120 lb./sq. in. and 250 deg. F., were supplied by John Thompson (Wolverhampton) Limited, to provide high-pressure hot water for space-heating and domestic purposes in the works and office areas. Each boiler is fitted with a total of 160 tubes, and is 9-ft. 6-in. dia., by 21-ft. long over the combustion chamber; the boiler flues (two for each unit) being 3-ft. diam. The combustion chamber is approximately 5-ft. long, the roof of the chamber being fitted with John Thompson special-type suspended arch blocks, while the circular portion, bottom and back-plate are firebrick lined, and a firebrick protection ring is provided at the back of each flue. The temperature of the combustion gases passing to the chimney is 285 deg. F., while the CO_2 measured at the gas outlet is normally 10 per cent.

Fuel-oil is stored in four 20,000 gal. capacity tanks, which are normally heated by a hot-water system, although electric heaters are installed as standby. Two

oil-heating and pumping units, incorporating Crompton Parkinson motors operating at 1,450 r.p.m., supply fuel to the burners at a temperature of 200 deg. F., and a pressure of 135 lb./sq. in. A Broom and Wade compressor, also driven by a Crompton Parkinson motor which is rated at 30-h.p., and operates at 1,430 r.p.m., supplies air for oil atomisation at the burners. Two burners are fitted to each boiler, and these, together with the heating and pumping units, were supplied by Laidlaw, Drew and Co. Ltd. The boilers are fully-automatic, and safety features incorporated ensure that the oil supply to the burners is cut off upon failure of the atomising air supply, or induced-draught plant. Provision is also made for the oil supply to be cut-off should excessive temperatures be experienced while the boilers are under manual control.



The three oil-fired Super Economic boilers supplied by John Thompson (Wolverhampton) Limited, and installed at the Simonstone Works of Mullard Limited. Each unit has a capacity of 9,250 lb./hr. at 120 lb./sq. in. and 250 deg. F.

The induced-draught fan provided for each unit was supplied by James Howden & Co. Ltd. All the i.d. fans were designed for a capacity of 8,500 cu. ft./min., and are driven by totally-enclosed squirrel-cage motors, operating at 1,450 r.p.m., and supplied by Crompton Parkinson & Co. Ltd. A damper, fitted in the short duct connected to each fan inlet, is controlled from the front of the boiler by operating gear, manufactured by Laidlaw, Drew & Co. Ltd. Soot-blowing equipment is of the lance-type, the actual units incorporated being approximately 12-ft. long.

Boiler valves and mountings, including double-spring safety valve, parallel slide valves, and blow-off valve, were supplied by Hopkinsons Limited, and the plant instrumentation by Electroflo Meters Co. Ltd., with the exception of the damper controls for which Laidlaw, Drew & Co. Ltd. were responsible.

The three self-supporting mild-steel chimneys were constructed by John Thompson (Dudley) Limited, each being 40-ft. high by 3-ft. diam. at the top, and 6-ft. diam. at the base. They are lined to a height of 20-ft. with 3-in. firebricks; this work being carried out by the Chimney Construction Company.

PLANT FOR CANADIAN NUCLEAR STATION

The Turbine Generator Division of **Associated Electrical Industries Limited** has received an order from Atomic Energy of Canada Limited for a 220-MW steam turbine-generator for the first Canadian nuclear power project, at Douglas Point on the eastern shore of Lake Huron. The turbine-generator set is the largest so far ordered from a British manufacturer for a nuclear power station. Certain parts of the machine will be made in Canada. A.E.I. is also supplying the 20-MW turbine-generator for NPD 2, the Canadian Nuclear Power Demonstration situated 150 miles up the Ottawa River. The latest order brings the number of steam turbine-generators ordered from A.E.I. for Canada to 22, with a total capacity of more than 1,990-MW, and ranging in unit output from 10-MW to 300-MW, and for installation in seven provinces. The 220-MW turbine-generator will be a two-cylinder unit to run at 1,800 r.p.m., the turbine operating with steam conditions of 565-lb./sq. in. and 482-deg. F., at the turbine stop valve. After expansion through the high-pressure stages in the first cylinder, the steam will be passed through external water-separators, and then a live-steam reheater, raising its temperature to 430 deg. F., and thence to the three-flow low-pressure section of the turbine. One low-pressure flow will be contained within the first cylinder; the other two will form a double-flow section, in the second cylinder. Each flow will terminate in a Baumann multi-exhaust stage, from which the steam will enter the condenser at a vacuum of 1-in. Hg. abs. The direct-coupled generator will supply 60 c/s a.c. at 18 kV 0.9 p.f., and will incorporate water-cooling of the stator windings, in conjunction with a hydrogen-cooling system operating at a gas pressure of 30-lb./sq. in. It will also be capable of operation as a synchronous condenser.

In connection with the attainment of the 21st anniversary of the **British Coal Utilisation Research Association,** a bibliography of all its publications during the years1938-1959 has been published. Copies are available from the Liaison and Publications Officer, B.C.U.R.A., Randalls Road, Leatherhead, Surrey, price 5s., post free. Intended for quick and easy reference, the bibliography indicates the location of accounts of the Association's past and current researches; to the discerning reader it also reveals the pattern and trends of the work of the Association during its first 21 years. A full classified subject index gives a ready guide to the wide variety of topics studied; in all, there are some 1,200 entries. The author index lists the names of past and present members of staff and their collaborators in the Universities and elsewhere, with references to their published work. Included in the bibliography are details of the patents taken out by the association, the books and the translations it has published.

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Mr. Gordon Blain has been appointed fuel supplies officer to the C.E.G.B., with responsibility for the Fuel Supplies Branch of the Operations Department of the Board. Mr. Blain will be assisted by **Mr. L. A. Didlick,** A.R.I.C., M.Inst.F., who has been appointed fuel officer (Supplies and Technology), and by **Mr. J. Laing,** F.S.S., F.R.Econ.S., Assoc. Inst.T., who is transport officer responsible for both inland and sea transport of fuel. **Mr. Arthur Haywood,** who, as Revenue Purchasing Officer, was previously responsible for fuel supplies, retired on December 31st, 1959, but will continue to serve the Board on a part-time basis in a consultative capacity. The Fuel Supplies Branch is responsible to **Mr. A. E. Hawkins,** B.Sc. (Eng.), A.M.I.E.E., chief operations engineer, headquarters, and is located at Buchanan House, 24/30, High Holborn, London, E.C.1.

RECENT Equipment AND Accessories

New Metricon pump

Metricon type-W pumps, manufactured by Metering Pumps Limited, are of the reciprocating-type, designed for adding solutions at a constant rate. Twelve standard models are available, and all the pumps have a fixed stroke length of 2¾-in. Typical applications are for pumping clear corrosive liquid, alkaline suspensions, and boiler feed conditioning reagents. Pump heads are of the ram-type, and rams are supplied in several diameters; either one (simplex) or two (duplex) heads may be fitted to the gear box. Suctions and deliveries of the heads can either be made together to give a greater capacity or operated separately for handling different solutions. Two solutions with the various pumping heads. All the pumps are designed to accommodate a square section packing, the type of material being used depending upon the liquid being handled. Pump heads can be modified to accommodate either chevron packing, or natural or synthetic rubber U-rings. Rams are completely guided and supported in the gear box fixing; they do not depend upon any part of the pump head for their alignment and it is, therefore, possible to use such materials as 18/8 stainless steel for all parts of the pump head. Pumps with special gland arrangements, steam jacketing or pump heads of special material can be supplied for specific applications. Metering Pumps Limited

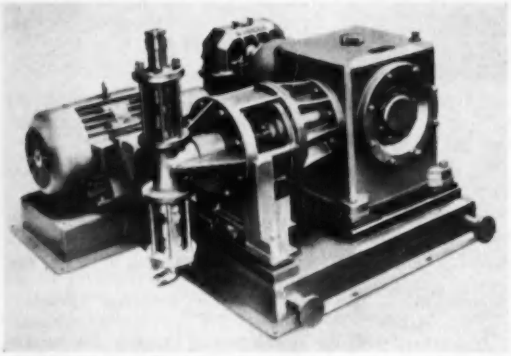


Fig. 1 (left). The new Metricon type-W pump for adding solutions at a constant rate. (Metering Pumps Limited.)

can thus be added in a fixed ratio by selecting pump heads with rams of different diameters. Capacities of the type-W pumps vary from 40 to 520 gal./hr. (simplex) and from 80 to 1,040 gal./hr. (duplex), while maximum working pressures vary from 250 to 3,000-lb./sq. in. The pump stroke speed can be varied manually by a variable-speed gear; automatic variation of speed can also be provided either by electronic or pneumatic means. The pumps may be supplied with a time switch arranged to stop the motor after a predetermined period, when restarting may be either manual or automatic, again after a pre-set period of time has elapsed. This feature, the company suggest, is particularly useful for the automatic "slug" feeding of phosphate to boiler drums. The electric motors provided (varying from 2-10 h.p.) drive the pumps through a reduction gear which may be either mounted separately or made integral with the motor. Various suction and delivery valves are available for use

have for some time now operated a plant hire scheme to enable experimental work in chemical dosing to be carried out by companies on their own premises, and to test the effectiveness of new processes in connection with their own specific needs. Plant available under this scheme consists of an electrically-operated variable-stroke chemical injection pump having a maximum output of 3.75 gal./hr., a rubber-lined mild-steel tank with a capacity of 20-gal., polythene delivery tubing and an injection fitting. All these units are mounted on a mild-steel frame. During hire, servicing will be carried out at no additional cost. (*Metering Pumps Limited, 21, The Mall, Ealing, W.5.*)

Safety mixing valve

Meynell & Sons Ltd. announce the introduction of a newly-designed Red Triangle safety mixing valve. It is manually-operated and eliminates the risk of scalding as the hot water supply is automatically, immediately and completely cut off in the event of cold water failure. The valve incorporates a number of features including a concealed pattern type as an alternative for fitting flush with the existing walls when the valve is installed. (*Meynell & Sons Ltd., Montrose Street, Wolverhampton.*)

Automatic oil-burner

Designed for incorporation as standard equipment on domestic oil-fired boilers and air heaters, a new fully-automatic light oil burner (Model ZL.2) is now available from Nu-way Heating Plants Limited. The new unit, which is equipped for either flange or pedestal mounting, incorporates standard burner components and a totally-enclosed motor. Servicing, the company say, is simplified by a hinged transformer which folds back to provide access to the interior of the burner and to the quick-release nozzle/electrode assembly. The Model ZL.2 is now being offered as standard or optional equipment on leading makes of oil-fired boilers, notably domestic models

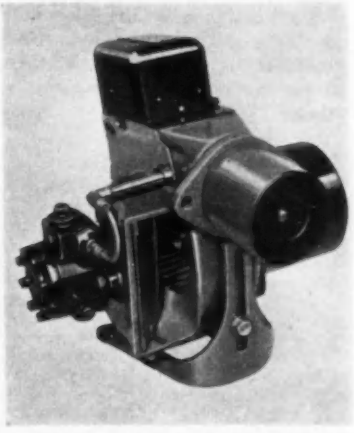


Fig. 2 (right). The Model ZL2, fully-automatic light-oil burner. (Nu-Way Heating Plants Limited.)

manufactured by Thomas Potterton Limited, Janitor Boilers Limited and The Beeston Boiler Co. Ltd. (*Nu-way Heating Plants Limited, Droitwich, Worcestershire.*)

Electro-slag welding

The principle involved in the Rockweld Limited "Vertomatic" slag-welding process is the fusion of parent metal and continuously fed weld metal under a substantial layer of high-temperature electrically-conducting molten slag. This method of welding is applied mainly to the vertical seaming of plates of medium

and heavy thickness. The plates are set up in a vertical plane and the square cut edges to be welded are positioned with a parallel space between them. The gap is bridged by water-cooled copper shoes on each side forming, in effect, a mould for the molten weld metal, and giving the required contour to the finished weld. The shoes are mechanised so that they move vertically upwards as welding proceeds. A prepared block is placed below the plate edges to close the welding cavity for starting. Granulated flux is dropped into the cavity and an initiating arc established with the electrode wire in a manner similar to the submerged-arc process. Arc energy, however, is used only initially to fuse the flux into molten slag which then, owing to its temperature, becomes a highly ionised mass offering a path of relatively low resistance to current flowing from the electrode wire to the pool of weld metal and the adjacent plate edges. Electrical energy expanded in the slag and weld metal in this way becomes the medium through which heat is maintained for continuous fusion of the electrode wire. To obtain consistent energy dissipation with thick plates a transverse motion, backwards and forwards, can be automatically imparted to the electrode wire as it is fed into the slag. Furthermore, for very thick plates, and with suitable equipment, two or three wires may be run into the same pool simultaneously. As the pool of weld metal builds up, the lower part is continuously cooling to form a homogeneous weld with effective penetration of the parent plates and with smooth clean external faces contoured by the copper shoes. (*Rockweld Limited, Commerce Way, Croydon, Surrey.*)

New bellows flowmeter

A new bellows-type flowmeter, incorporating automatic temperature and static pressure stabilising, was recently introduced by Honeywell Controls Limited. It is claimed to be extremely stable in operation, and has been designed to operate efficiently with ambient temperatures between − 40 deg. F. and + 250 deg. F. The instrument incorporates a rapid pulsation damping device. It is also suitable for liquid-level measurement, and has an accuracy of ± 0.5 per cent. full scale differential pressure. Positive overload protection is provided. Fifteen different ranges from 0-20-in. water to 0-400-in. water are available; only the simplest component change being necessary for range changing. A large bellows system and torque tube assembly gives high torque and power output for the operation of additional elements. The flowmeter can be used in conjunction with integrally-mounted or remote reading indicators, recorders or controllers; automatic flow totalising on a six-digit counter can also be incorporated. The bellows and all parts of the bellows assembly exposed to the process fluid are of stainless steel, making the flowmeter suitable for use with almost any process fluid. Ease of installation is assured by pressure connections for vertical and horizontal piping which can be positioned at either the top or the bottom with no change of parts. (*Honeywell Controls Limited, Ruislip Road East, Greenford, Middlesex.*)

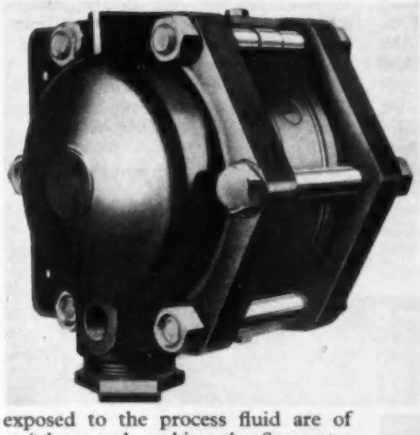
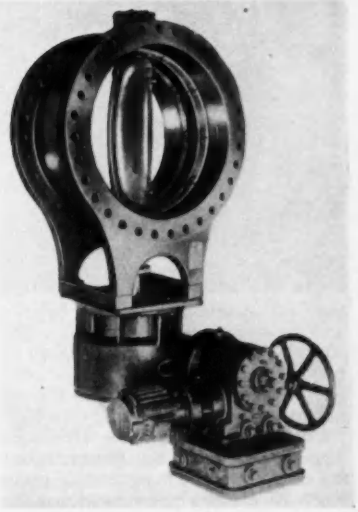


Fig. 3 (left). The new Honeywell bellows-type flow meter, incorporating automatic temperature and static-pressure stabilising. (Honeywell Controls Limited.)

Fig. 4 (below). A model from the range of Cockburns-Rockwell "leak-tight" valves. This type of valve is being supplied for the Athens water system. (Cockburns Limited.)



Power plant for steelworks

A contract, valued at £2-million, for power plant and electrical equipment has been placed with The General Electric Co. Ltd. by Colvilles Limited. The plant and equipment will be installed in extensions to the power station at Colvilles Ravenscraig Iron and Steel Works, near Motherwell. Included in the contract are two turbo-generators, one rated at 20-MW, 30-MVA, and the other 12-MW, 28-MVA; a turbo-blower rated at 90,000 cu. ft./min. and 40 lb./sq. in.; a 200,000-lb./hr. gas-fired boiler; feed-heaters, condensers and ancillary plant; and all the motors, switchgear, transformers and cabling for auxiliary services. Also being supplied are two 30-MVA 33/11-kV transformers and the necessary 33-kV and 11-kV switchgear. In addition, the company will manufacture a 19-panel, 33-kV switchboard for a new sub-station taking a supply from the South of Scotland Electricity Board's 275-kV grid system. This switchgear will be linked to the steelworks' power station through two 30-MVA reactors which, together with all the associated 33-kV cabling for the sub-station, will also be supplied by G.E.C. The General Electric Co. Ltd. were responsible for the complete power house associated with the first stage of the Ravenscraig project which commenced operation in the summer of 1957. (*The General Electric Co. Ltd., Erith, Kent.*)

Water valves

An order valued at £50,000, covering the supply of valves for the Athens water system, has recently been secured by Cockburns Limited. The valves to be supplied are from 4-ft. to 6-ft. dia., made in Meehanite iron with special rubber seats, which ensure an absolutely tight shut-off without leaks. They are based on U.S. designs which Cockburns manufacture under licence. The Athens water system is one of the most modern in Europe, and receives its supply from the 40,000,000-gal. reservoir at Marathon, some 25-miles from the city. The system is being extended to meet the needs of a

greatly increased population, and the demands made by the establishment of industrial organisations in the area. (*Cockburns Limited, Cardonald, Glasgow, S.W.2.*)

Packaged boilers for fuel oil depot

Recently, the Regent Oil Co. Ltd. established a fuel-oil depot as an extension to the existing petroleum storage and distribution depot at Woodlesford, near Leeds. At the present time, there are in the new depot, three oil-storage tanks, for heavy, medium and light fuel oils, each having a capacity of 91,000 gal.; the oil being available for distribution, by 14-ton capacity road tankers, to the North and West Ridings of Yorkshire. The storage tanks are heated by means of steam coils to allow ease of handling; heavy fuel oil is held at a temperature of 100 deg. F., medium fuel oil 90 deg. F. and light fuel oil 60 deg. F. The steam supply for this purpose is provided by two "Powermaster," fully-automatic, oil-fired packaged boilers manufactured by G.W.B. Furnaces Limited (Boiler Division). The two Model 60 Powermasters are each capable of generating up to 2,070 lb./hr. at a pressure of 100 lb./sq. in. One boiler is of sufficient capacity to provide the present steam requirement, the second acting as a standby unit, while also being available should there be a further expansion of the depot, at some future date. Each boiler occupies a comparatively small floor space, measuring 11-ft. long × 6-ft. wide and is 8-ft. 3-in. high. As with other units in the Powermaster range (517 to 20,700 lb./hr.), they were works tested before despatch, being immediately available for connection to the fuel, water and electricity supply on site. Since the units are completely smoke-free and operate on a forced-draught system, only a relatively short length of ducting is required for fume extraction, and expenditure on a large chimney is thus unnecessary. The "Voriflow" oil-burners provided are claimed to allow a high efficiency, of about 80 per cent., to be maintained on all loads down to 20 per cent. of boiler capacity. A storage tank of 6,000 gal. capacity is available for the boiler fuel-oil supply, and is provided with a steam coil heating system, thermostatically-controlled to maintain the oil at a temperature of approximately 100 deg. F. [*G.W.B. Furnaces Limited (Boiler Division) Dudley, Worcs.*]

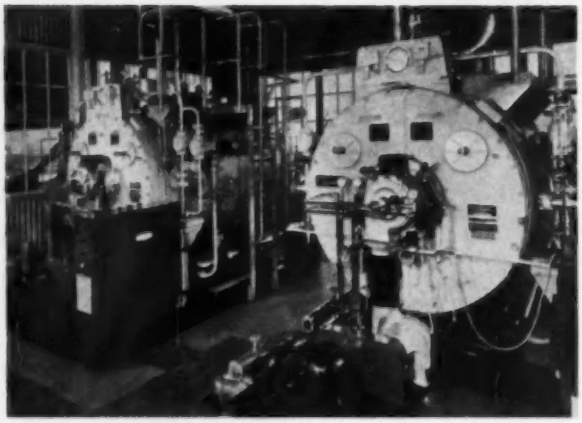


Fig. 5. The two Model 60 "Powermaster" boilers installed at the Woodlesford Depot of the Regent Oil Co. Ltd. (G.W.B. Furnaces Limited.)

New insulation for enclosed fan-cooled motors

By adopting Class "E" insulation instead of Class "A" for their totally-enclosed fan-cooled motors, Newman Industries Limited have now made available a range of machines with outputs up to 100 per cent. greater than existing motors of the same type and frame size. An extremely tough polyester film known as "Melinex," and produced by I.C.I. Limited, is one of the new and improved insulating materials used for this purpose. Dimensionally the new motor, which is known as type "D," is identical and therefore interchangeable with the "C" type ventilated motor to British Standard 2960. With the improved insulation Newmans can offer a motor of smaller dimensions at a lower price than the Class "A" insulated type "B" machine which it replaces. For example, a 40-h.p. motor of the new "D" type will be produced in the same frame size as the earlier 20 h.p. "B" type machine. This is achieved by the Class "E" insulation which permits a temperature rise of 65 deg. C. above 40 deg. C. ambient compared with the 55 deg. C. of Class "A" insulation. The output range is covered by 12 frame sizes, from ½-50 h.p. with speeds from 3,000-750 r.p.m. or 3,600-900 r.p.m. The motors can be wound for voltages up to 650-V or for non-standard power supplies if required. Production is beginning immediately of motors from ½ h.p. at 750 r.p.m. up to 5 h.p. at 3,000 r.p.m., and by the end of 1960 the range will be extended to 50 h.p. (*Newman Industries Limited, Yate, Bristol.*)

Stainless steel centrifugal pumps

A new range of stainless-steel centrifugal pumps, designed specifically for the chemical and allied industries, has been developed by Holden & Brooke Limited. These units follow the basic pattern of other pumps in the well-known J-range, which cover all applications in the centrifugal field, from low-pressure to high-temperature/high-pressure. Known as the JTV-series, the new stainless-steel pumps are supplied in four standard sizes up to a maximum capacity of 425 gal./min. and a head of 250-ft. Total working pressures, based on the combination of the developed head and the static pressure, range from 90 lb./sq. in. to 125 lb./sq. in. All contact parts on JTV pumps are of high-grade stainless-steel, resistant to any corrosive liquid and, for highly corrosive chemical processes, the pumps may be fitted with a specially-protected gland drip-tray. Stainless steel is used in the construction of the body, cover, stuffing-box, gland, impeller, shaft, shaft-sleeve and neck-rings. The pedestal, bearing cover and bedplate are in cast-iron. Mating flanges are drilled to B.S.T. "C" and unified threads are used through-

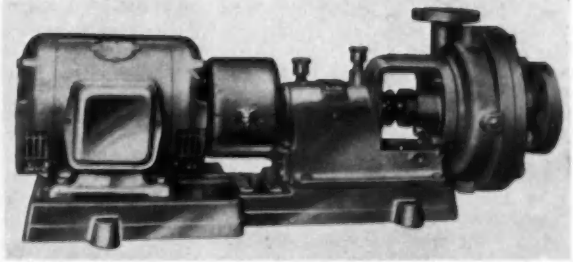


Fig. 6. A model from the JTV-series of stainless-steel centrifugal pumps. (Holden and Brooke Limited.)

out. Three basic gland arrangements are available—a sleeve-packed gland which may be water-cooled if required; a single mechanical sleeve for normal duties; and a single seal of the Fluon-type for highly-corrosive applications. Standard or special motors can be fitted to customer's requirements. (*Holden & Brook Limited, Sirius Works, Manchester*, 12.)

Flame-failure control

Urquhart's (1926) Limited have recently announced the introduction of the "MacEye" flame-failure control, a completely self-contained unit of compact design, with all the components assembled on a printed circuit base. Three terminals are provided for external wiring, and an earth connection is made automatically when the chassis is assembled into the case. A shorting-out switch is included for starting-up, a lamp is provided to indicate flame-in or flame-out, and a fixed period delay device prevents unnecessary tripping action which might be caused by light or flame flicker. A cadmium sulphide photo-conductive cell of high sensitivity operates a plug-in double pole change-over relay without any amplification, which not only reduces the cost of the unit, but eliminates valves, etc., making it more reliable. Contact rating is 50 watts at 230 volts. The sensitivity level is adjustable to suit any oil or gas flame which provides the minimum illumination required to operate the relay. A push-button switch is included in the circuit for shorting out the circuit to allow light or flame source to be established. Maximum working temperature is 120 deg. F. Although the "MacEye," as a basic photo-conductive switch, has been primarily designed for application to flame protection in association with oil burners, it can be incorporated in process control systems using an interrupted light beam. [*Urquhart's (1926) Limited, 5, Wadsworth Road, Perivale, Middx.*]

Coal preparation plant

The British General Electric Co. (Pty.) Ltd., Johannesburg, which represents The General Electric Company Limited, of England in South Africa, has received contracts, worth approximately £230,000 for two coal-preparation plants. The Chance sand-flotation process will be employed in both installations, and the plant will be supplied by G.E.C. The primary screening and conveying sections of the plant will be provided by Robins Conveyors (S.A.) Limited, with whom the G.E.C. has close relations in this class of work. The first plant will be situated at the Landau Colliery of the South African Coal Estates (Whitbank) Limited, and will clean 6 in. × ¼ in. raw coal at the rate of 350 short tons per hour. The second, for Natal Navigation Collieries and Estate Co. Ltd., will be built at their Kilbarchan Colliery and will handle 6 in. × ¾ in. coal at the rate of 320 short tons per hour. The clean coal from the latter plant will be employed entirely for steam raising in power stations, but the Landau plant will produce up-graded sized coal for the domestic market. Most of the equipment associated with the Chance cleaning sections will be manufactured in South Africa to the designs of the Erith Engineering Works of G.E.C., but some will be made at Erith. The British General Electric Co. (Pty.) Ltd., will be responsible for the co-ordination of the work with Robins Conveyors (S.A.) Limited and for the building and civil engineering work associated with the cleaning sections of both plants. (*The General Electric Co. Ltd., Erith, Kent.*)

Tramp iron diverters

Rapid Magnetic Limited announce that their range of tramp iron diverters has now been extended to cover burdens beyond the capacity of conventional pulley and pulley-type separators. A typical unit for the recovery of iron-bearing slag is 42-in. dia., 60-in. wide and weighs approximately 6½-tons. High-temperature class "B" insulation is used throughout, making the equipment suitable for the treatment of hot slag, whilst the drum cover is of substantial thickness of stainless-steel provided with expendable outer covers. (*Rapid Magnetic Limited, Lombard Street, Birmingham*, 12.)

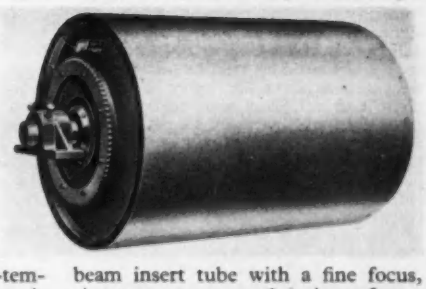


Fig. 7. The Rapid Magnetic tramp-iron diverter for heavy burden depths. (Rapid Magnetic Limited.)

Regulator for central heating

An entirely new type of domestic central heating regulator (Prov. Patent No. 29881/59) is now available from Hattersley (Ormskirk) Limited. In this new design the handwheel and stem of the conventional valve have been dispensed with, for the new regulator incorporates a sleeve which rotates in the cast gunmetal body. Movement of the sleeve is controlled by a neat ivory-coloured head incorporating a complementary grey indicator plate. The regulator is instantly adjustable by fingertip pressure. The sleeve design ensures that the regulator can be fully-closed with no more than the light pressure necessary to obtain the desired setting. A further feature is the simple scale for the control head indicator which gives exact settings, from fully-open to closed, for ¼, ½ and ¾ of the radiator's potential. Previously, with a conventional valve, obtaining the correct setting was a matter of experiment. The regulator is manufactured in ½ in. size in both angle and straight patterns, and a lock-shield type is also available. [*Hattersley (Ormskirk) Limited, Ormskirk, Lancashire.*]

New portable X-ray unit

A new lightweight, portable industrial X-ray unit of 300-kV capacity, known as the Baltospot G300D, and designed for the examination of mild-steel of up to 3-in. thickness, has been introduced by Pantak Limited. Both insulation and cooling of the X-ray tube in this unit is effected by a chemically and physiologically inert and non-inflammable gas, the use of which results in a lightweight tank head construction and achieves a high power/weight ratio. The unit can be supplied with either a conventional 40° solid angle beam insert tube with a fine focus, size 3.0 mm., or a 360° circumferential radiation insert tube. Cooling of the anode is achieved in either case by forced-circulation of the insulating gas by means of an internal blower. The tank head, which is cylindrical in shape, is pressurised. The tube is protected against excessive temperature by a thermoswitch mounted in the tank head, while a further device in the control unit simulates the thermal capacity of the anode and gives the operator a visual indication of overheating. A particular advantage claimed by the company is that a series of exposures can be planned without risk of overheating the tube. The maximum dimensions are 40-in. long × 9-in. dia. When fitted with a protective

cradle, incorporating anti-shock mountings, the weight is increased from 142-lb. to 171-lb. The control unit is of the carrying-case type, the maximum dimensions being 18-in. long × 14-in. wide × 8-in. deep. The control operates from a 220-V 50 c/s single-phase supply, and accommodates fluctuations of 10 per cent. either way. It is fitted with direct-reading kilovolt and milliammeters in addition to a synchronous timer which can be arranged for automatic repetition of exposures. The kilovoltage and tube current controls are of the stepless type giving continuously variable control. Among standard accessories supplied is a telescopic centre finder, end rings for tank head, cables, etc. (*Pantak Limited, Vale Road, Windsor, Berks.*)

The General Electric Co. Ltd., England, has received a repeat order from Johannesburg Municipality valued at more than £1¼-million for two further 60-MW turbo-generator sets, complete with feed-heating plant, for Kelvin "B" power station. This latest order covers the third and fourth sets for the station, an order for the first two machines being already in hand. The turbines are designed for steam conditions of 900-lb./sq. in. and 900 deg. F., at the turbine stop-valve, and each set is provided with five-stage feed-heating plant giving a final feed temperature of 370 deg. F. The alternators are hydrogen-cooled at a pressure of 30 lb./sq. in., and generate at 11-kV, three-phase, 50 c/s. G.E.C. has already supplied five 30-MW sets for the "A" station, and the sixth is now being erected on site. With this latest contract, the number of G.E.C. sets in Johannesburg's four power stations will total 27, providing more than 750-MW. The consultants to the municipality are Messrs. Merz and McLellan, Newcastle.

* * *

Lodge-Cottrell Limited have received an order worth approximately £720,000 for the blast-furnace gas-cleaning plant at the Spencer Works, Newport, of Richard Thomas and Baldwins Limited. This is stated to be the largest single order ever secured by the company, and the plant, which is designed to operate at high gas-pressure, will consist of gas-cooling and scrubbing towers, followed by electrostatic precipitators, together with water clarifying plant and filtration and dust-recovery plant. It will eventually deal with 20 million cu. ft./hr. of gas at N.T.P. Lodge-Cottrell Limited claim to be the pioneers of electrical precipitation in this country, and were founded nearly 50 years ago to develop the research work of the late Sir Oliver Lodge, one time Principal of Birmingham University.

* * *

Richardsons Westgarth (Hartlepool) Limited, a member of the Richardsons Westgarth Group, have now received the order from the C.E.G.B. for the third 120-MW turbo-alternator set for Richborough power station (Kent). Richardsons Westgarth have already been awarded contracts for Nos. 1 and 2 sets. The turbines will be of the three-cylinder high-pressure reheat type and the alternator will be hydrogen-cooled.

* * *

The Morgan Crucible Co. Ltd., Battersea Church Road, London, S.W.11, have issued a new leaflet (SD 63/59) entitled "Morganite Carbon Bearings." These bearings are designed and manufactured for special purposes, where ordinary bearings are unable to cope with the work demanded of them. One of the three principal fields of application is in connection with furnace and boiler plant equipment, where operating temperatures are too high for the use of ordinary lubricants.

A new research reactor constructed for the **United Kingdom Atomic Energy Authority** started operation on February 29th. The reactor, construction of which began in 1958, is known as "Herald," and situated at the Atomic Weapons Research Establishment, Aldermaston. It will be used for nuclear research work requiring intense neutron beams and for irradiation-damage studies on reactor materials. "Herald" is a light water-moderated and cooled tank-type thermal reactor designed to operate at 5-MW continuously. The core of the reactor is in the form of thin plates of enriched uranium-aluminium alloy suitably spaced in water. A high flux density of thermal and fast neutrons of the order of 10^{14} neutrons per cm^2 will be achieved. The reactor was built for the U.K.A.E.A. by the A.E.I./John Thompson Nuclear Energy Co. Ltd., and is an adaptation of that company's "Merlin" reactor to an A.W.R.E. specification.

* * *

The Chemical Engineering Division of **W. C. Holmes & Co. Ltd.,** Huddersfield, have received an order, approximate value £31,000, for the installation of a complete briquetting plant at the Kingston-on-Thames "B" power station of the Central Electricity Generating Board. This plant has been designed in collaboration with Neldco Processes Limited and Conreur Ledent et Cie of Raismes, France, who will supply the press. The plant will produce 10 tons of ovoids per hour, using grit taken from the station's dust-collection system, mixed with fine coal. Liquid pitch will be used as the binder. The ovoids will be burnt on standard chain-grate stokers. The plant is scheduled to be in operation before the end of 1960.

* * *

Transport of tonnage oxygen plants in a near assembled state is being effected for the first time. Two plants, each of which will produce 100 tons of oxygen a day, were moved recently by road from the Edmonton works of **British Oxygen Engineering Limited,** to the Scottish Gas Board's site at Westfield in Fifeshire, where they will play an essential part in the production of town gas by the Lurgi process. These oxygen plants are the first of a new type. Transport of the two oxygen plants in a virtually assembled state will save many manhours in erection time compared with conventional plants, which are erected wholly on site. To achieve this saving, however, major transport problems had to be solved. The project has already involved manoeuvring such parts as two 24-ton air separation units—which are 35 ft in length and 12 ft. in diameter—on to trailers, while the opposite problem will have to be overcome at the Westfield site. An illustrated description of progress to date at Westfield was published in the December, 1959 issue of this Journal.

Three-day courses on oil-firing are arranged at frequent intervals by the **National Industrial Fuel Efficiency Service.** To date 42 courses have been held, and 899 engineers from industry have taken the course. The next one will be held from May 3rd to 5th, 1960, at Ailsa House, Kings Road, Reading. The course has been designed to meet the needs of industrial plant engineers, heating engineers and supervisory staff responsible for oil-fired boiler plants. The fee for the course, exclusive of hotel accommodation, will be six guineas. Application forms and a course syllabus may be obtained from the National Industrial Fuel Efficiency Service, 71, Grosvenor Street, London, W.1. (Tel.: Hyde Park 9706.)

* * *

In London on March 7th, **Mr. Daigoro Yasukawa,** president of the Japan Atomic Power Company, and **Sir Roger Makins,** chairman of the United Kingdom Atomic Energy Authority, signed the "Heads of Contract" for the supply of natural uranium fuel-elements for the nuclear power station which the General Electric Company are to build in Japan for the Japan Atomic Power Company. The contract between the Japan Atomic Power Company and G.E.C. was signed on December 22nd, 1959. The document now signed establishes the main features of the detailed contract which will govern the supply of new fuel and the repurchase of irradiated fuel during the first ten years of the reactor's operation. This detailed contract is not due to be signed until early 1962, about a year before the first deliveries of fuel are required. The agreement of Heads of Contract is a further step toward implementing the Letter of Intent to supply the fuel for this station which the Atomic Energy Authority gave to the Japan Atomic Power Company in April, 1959.

* * *

Mr. E. F. E. Howard, of Hayward Tyler & Co. Ltd., chairman of the Council's subsidiary company, British Oil Equipment Credits Limited, announces that the Mission to Argentina, organised by The Council of British Manufacturers of Petroleum Equipment, is now being extended to Chile. Mr. Howard, who is leading the mission, stated that they hoped to reach Santiago by the end of March. The British Embassy and the British Chamber of Commerce in Santiago are helping the mission to establish contacts, especially with E.N.A.P. (Empresa National de Petroleo) to discuss the possibility of supplying all types of British petroleum equipment to Chile.

* * *

The address of the London office of **Stockton Chemical Engineers and Riley Boilers Limited** is now 232, Bishopsgate, London, E.C.2. (Telephone: Bishopsgate 3575/6.)

OVERSEAS Steam Engineering Practice

Abridgments of recent articles in the colonial and foreign technical press, concerning design and progress in the technique of steam generation and power plant equipment

700-MW power station for Sweden

The first stage of the Swedish State Power Board's new Stenungsund underground thermal power station, situated on the west coast of Sweden, north of Gothenburg, has a capacity of 150-MW. It was recently commissioned, and a further stage of the same capacity is expected to be completed this autumn. The ultimate capacity of the station will be in excess of 700-MW, making it Sweden's largest power plant. The new station is constructed in the solid bedrock of a mountain; only the 280-ft. high chimneys, and the main switchgear being visible above ground level. Work on the Stennungsund station commenced in 1955; the design and construction being carried out by the State Power Board. The plant and equipment is being supplied by a number of leading Swedish firms, including Stal (de Laval Ljungstrom), who are responsible for the turbines, the largest ever built by the company; Svenska Maskinverken, who are responsible for the boilers; and Svenska Flatkfabriken, the extensive ventilation equipment. ASEA are responsible for the transformers, switchgear, etc., and Nordarmatur, the high-pressure valves. The civil engineering work for the new station necessitated the removal of 1,570,000 cu. yd. of rock for the four underground machinery bays, access tunnels, etc. Each of the two bays required for the first stage has a length of 410-ft., a width of 69-ft. and a height of 98-ft., while the two remaining bays are somewhat larger. Each machinery bay forms a separate unit, and includes a ventilation section, a boiler, high- and low-pressure turbines, generator and transformer. A large volume of air is required for ventilation, as the equipment installed has a capacity of 50,400 cu. ft. of air per hour. The grit and dust-collection units for each boiler have been designed to treat over 32-million cu. ft./hr. of combustion gases, with an efficiency of 90 per cent. The reheat boilers, manufactured by Svenska Maskinverken are designed for an evaporative capacity of 992,250 lb./hr. at 986 deg. F. They are of the horizontal type, and are oil-fired, each being fitted with 16 burners. The 150-MW turbo-alternators are the first in Sweden to operate with hydrogen-cooled alternators. Seawater is used for condenser cooling, and to bring the necessary supply to the station, tunnels, some 3,282-yd. in length, and capable of handling a total of 528,000 gal./min., have been excavated.

New boiler for district-heating plant

A new design of Velox boiler has been supplied by Brown, Boveri & Co. Ltd., and installed as part of the district-heating plant of Basle City Electricity Authority. The boiler has been designed for a capacity of 70,560 lb./hr. at 640 lb./sq. in. and 860 deg. F., with feedwater at 221-248 deg. F. The connection to the district heating system is made at a pressure of 170.7 lb./sq. in., via a Brown Boveri back-pressure turbine rated at 1,800-kW. The compactness and low weight of the new unit made it possible for the steam generator to be installed next to the turbine in the machine room. The combustion-chamber, the evaporator, the superheater and the regulating evaporator are united under a single heat-insulating enclosure. Immediately adjacent, on the machine room floor, is the charging set. The feedwater heater is connected to the exhaust-gas flue of the gas turbine, just before the chimney. Mounted in a convenient part of the basement are the auxiliaries. All tube banks and walls of tubing are surrounded by an insulating enclosure to prevent loss of heat. The combustion space and each of the main banks of tubes is enclosed in a pressure-tight cylindrical shell. Between this shell and the insulating enclosure flows the cooling air. All suspensions and fixings are mounted away from the main stream of gas and cooled by air, water or steam, so that they are not corroded by the hot gases. The internal parts are suspended in such a way that they can expand freely;

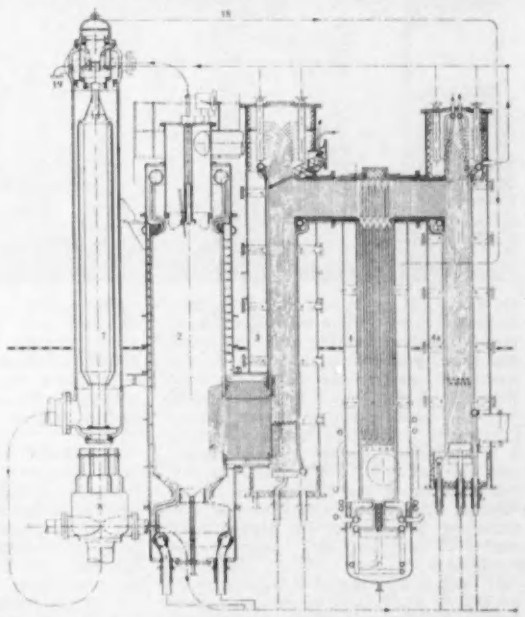


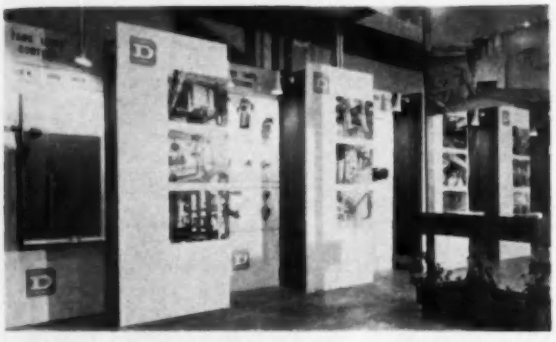
Fig. 1. Diagrammatic arrangement showing pressure-charged sections of the new plant of the Basle City Electricity Authority.

KEY:—
(2) Combustion chamber. (3) Evaporator. (4) Superheater. (4a) Regulating evaporator (limiting live-steam temperature). (7) Water separator. (8) Circulating pump. (18) Saturated steam to superheater. (19) Feedwater inlet.

the weight is taken by the outer shell. The arrangement of the combustion chamber with its burners enables combustion to take place with a minimum of residue. By correctly dimensioning the swirl vanes and positioning them along the principal axis, the flow inside the chamber ensures that the fuel is in the correct state for burning. Fully-evaporated by the hot gases, pre-heated and dissociated into its components, thoroughly and rapidly mixed with air, the fuel finally burns completely. These actions are effectively encouraged by the fine atomisation resulting from combustion under pressure. In the combustion chamber the minerals dissolved in the microscopic oil droplets are subjected to the highest prevailing temperatures. As the gases pass along the cold walls the viscous drops produced by the minerals solidify and form grains; in the evaporator the gases then flow between the cold walls. Encouraged by the extraction of a large amount of heat, the cooling effect on the slag droplets is intensified. In the gas-turbine casing the concentrating dust is removed from the turbine blading through extraction slits with a small fraction of the gas. In addition to the correct treatment of the fuel in the combustion chamber, the convection heat, which can no longer be ignored in operation under pressure, is also taken into account. The superheater is of conventional design, and the regulating evaporator operating in parallel with the superheater on the gas side allows the temperature to be kept accurately at the desired value. The regulating evaporator operates under more favourable conditions than the evaporator proper. The gas turbine can be utilised for generating electricity. The remaining parts of the plant, such as the feed-heaters, pumps, motors, metering and supervisory instruments, are all of standard design. The most important supervisory instruments are incorporated with some of the control elements in a switchboard. (*The Brown, Boveri Review*, Vol. 46, No. 7, pp. 371/380).

Drayton Controls (Heating) Ltd.

The space-heating and air conditioning control business of the Drayton Regulator and Instrument Co. Ltd. is now handled by a new company, Drayton Controls (Heating) Limited, and Mr. G. F. Brown has been appointed general manager and director of the new organisation. The scope of the new company's activities, and certain new developments were displayed at an exhibition held in London from March 1st to 11th, and in Birmingham from March 21st to 25th, 1960. Included in the exhibition was the new Drayton Teletronic Variostat—



Part of the exhibition which was staged recently in London, and Birmingham by Drayton Controls (Heating) Ltd.

an electronic system of indoor/outdoor heating control. The controller incorporates printed circuits and transistors, and gives proportional control. A new room thermostat—the R.59—was also shown. This utilises a Hydroflex metal bellows thermosensitive system, incorporates an accelerator heater to enable it to anticipate changes in temperature, and will switch a 3-kW heater at 200-V a.c. without the use of additional relays. Among other demonstrations was one depicting the control of high-velocity dual-duct systems, and showing the application of the "Dialset" temperature indicating controller (master/sub-master) to the control of the main plant with individual pneumatic controls for the attenuator boxes. Another pneumatically-operated demonstration showed the application of Drayton controllers, valves and thrusters to a plenum plant. Also included was a display of valves, steam traps and other accessories.

"Wiggin High-Nickel Alloys v. Sulphuric Acid" is a new publication issued by **Henry Wiggin & Co. Ltd.** It is the latest of a series of publications issued by the company, and it deals with the corrosion-resisting properties of high nickel alloys. These are well-known in the field of chemical and process engineering, and this publication, gives much detailed information, with numerous photographs and tables, on the particular properties of the alloys. The publication is obtainable free on request from Henry Wiggin & Co. Ltd., Publicity Dept., Thames House, London, S.W.1.

Babcock & Wilcox Limited have issued a new leaflet (publication No. 1716) entitled "Babcock Paddle-type Mixer-conveyors." The leaflet provides information regarding capacities of these machines, standard sizes, drive details and particulars of operation.

* * *

Rockweld Limited have issued a new brochure which describes their recently-introduced Comet Process—semi-automatic welding with CO_2 shielding. In the Rockweld Comet Process, the arc is struck between a special composite continuous wire and the work piece in an atmosphere of carbon-dioxide gas. The wire contains the deoxidising agents and the slag forming materials, whilst the carbon-dioxide protects the metal from atmospheric contamination during transfer and in the weld pool. It is thus a visible-arc process, and is readily adaptable for both automatic and semi-automatic operation.

Oil Burner Components Limited, Vines Lane, Droitwich, Worcester, recently inaugurated new headquarters comprising head offices of the company, and 20,000 cu. ft. of storage space for the very extensive range of controls, accessories and spare parts for heating equipment distributed by the company. The building is heated by radiators and radiant panels supplied by the Potterton DOA oil-fired boiler unit fitted with a Nu-way Model KL.2 burner. Opening of the new company's head office coincided with the publication of the 1960 O.B.C. Catalogue, which lists the very wide range of automatic heating components and accessories available ex-stock, or on early delivery from any of the ten O.B.C. depots throughout the United Kingdom and Eire. Still growing rapidly two years after its formation, O.B.C. Limited is now operating nine branch stores in London, Glasgow, Manchester, Newcastle, Bournemouth, Cardiff, Belfast, Dublin and Bristol in addition to the main store in Droitwich.

* * *

Mr. R. H. G. Sutton, managing director, Urquhart's (1926) Limited, combustion engineers and oil-burner manufacturers, Perivale, Middlesex, and Albion Dockyard, Bristol, has been appointed, in addition to his duties as managing director, deputy-chairman of the company. **Mr. G. T. Furman,** technical manager, has been appointed a director.

* * *

The 1960 edition of **"The Engineer" Buyers' Guide** was published on February 29th, by our contemporary *The Engineer*. This latest edition contains 976 pages, including the "Buyers' Guide" section (2,650 classified products with 34,750 entries), "Address" section (1,850 firms), and lists of U.K. Agents for Foreign Firms, Trade Names, Associations, Institutions and Societies connected with the Engineering Industry, National Undertakings and Forthcoming Engineering and Industrial Exhibitions. Any subscriber, or regular reader, who has not yet received a copy should write to the Manager, *The Engineer*, 28, Essex Street, Strand, London, W.C.2. Additional copies are obtainable at 7s. 6d. each (postage 1s. 9d. extra).

Latest Power Plant Patents

These extracts from British Patent Specifications are reproduced by permission of The Controller of H.M. Stationery Office. (Complete British Specifications can be obtained from the Patent Office, 26, Southampton Buildings, London, W.C.2. Price 3s. 6d. each, both inland and abroad.)

Recuperative heat exchanger

In recuperative heat-exchangers made of heat-resistant steels, and also in such recuperators having tubes made of ordinary ingot or mild steel, it is of importance that at the hotter ends of the tubes the temperature should not be so great as to affect the strength of the steel. To avoid this, the practice of lining the steel tubes through which the hot gases flow, wholly, or at least at the hotter ends, with ceramic inserts has been tried. It has, however, been found that it is impossible, or at least very difficult, to cause the protective ceramic layer to adhere to the tube walls, as the coefficient of thermal expansion of steel is several times higher than that of the ceramic material. According to this present invention, a recuperative heat-exchanger is provided with tubes made of ordinary ingot or mild-steel, in which the ceramic inserts or linings for the tubes are mounted on the inner surfaces of the tubes by means of inwardly projecting members which are welded or otherwise secured to the tubes, and engage in grooves provided at corresponding positions in the inserts or linings. Preferably, short ceramic tube sections having a length of a few hundred millimetres are used, which are provided with longitudinal grooves, the dimensions of which correspond to the dimensions of the projecting members. The ceramic tube sections are slid into the tubes along the projections, on which they are mounted by being turned relatively thereto into an intermediate position. The ceramic inserts are not securely connected to the steel tubes of the recuperator in any way, but lie loosely within them. They are secured by the projections against falling out, even when the recuperator is exposed to substantial vibration. Fig. 1 shows a sectional side elevation of only a single vertical steel tube with its ceramic inserts. Fig. 2 shows a cross-section of a steel tube with the ceramic insert at the level of the locating projections, and Fig. 3 a sectional elevation on an enlarged scale of the lower end of the steel tube. The steel tube is denoted by numeral (1), (2) being the ceramic inserts, a number of which are mounted in superposed series in the tube. The projections (3) are welded to the tube (1). A tube-plate (4) is insulated on the under face by a ceramic mass (5) against the hot fire gases which flow through the steel tube (1) in the direction of the arrow (6). The longitudinal grooves in the ceramic inserts are denoted by numeral (7). An annular groove indicated by (7a) is provided, extending at right-angles to the grooves (7) at the lower-end of the lowermost insert (2a) and at an angle, for example, of 90° to the grooves (7). The projections (3) engage in the groove (7a) so that on the occurrence of substantial vibration, unintended slackening back of the insert is avoided. Thus, the ceramic insert can never inadvertently fall out of the tube (1). Insertion of the inserts (2) into the tube (1) is extremely easy, the fitting of the inserts being nevertheless absolutely secure. Removal can also readily be effected whenever desired. *British Patent No. 825,947 issued to A. Schack trading as Rekuperator K. G. Complete specification published December 23rd, 1959.*

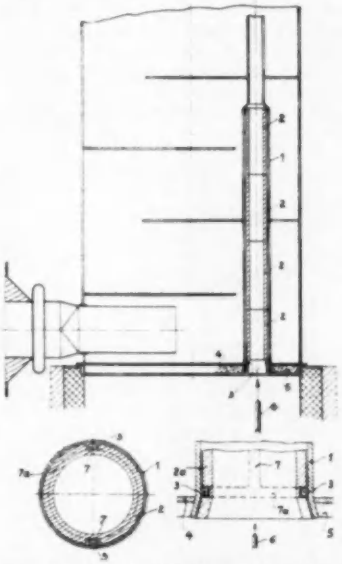


Fig. 1 (top). Fig. 2 (bottom, left). Fig. 3 (bottom, right). British Patent No. 825,947.

System for firing boiler furnaces

This invention relates to a system for feeding and firing a boiler furnace with solid fuel, and includes a travelling-grate stoker and at least one burner for pulverised-fuel-firing, located within the combustion chamber. Referring to Figs. 4 and 5, it will be seen that (1) denotes an upright duct connected by a branch duct (2) to a bunker (3), while (4)

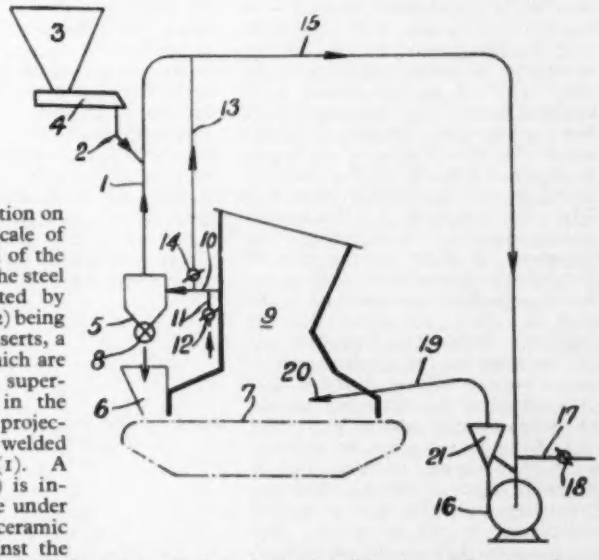


Fig. 4 (right). British Patent No. 827,233.

denotes a feeder intercalated in the branch duct (2) for regulation of the flow of fuel from the bunker (3) to the duct (1). The lower end portion of the duct (1) projects into a hopper (5), the mouth of which is located directly above a second hopper or chute (6) leading directly to a travelling-grate stoker (7). A seal (8) is interposed between the hoppers (5 and 6) to prevent flow of air to the interior of the hopper (5). Flue gases from the combustion chamber (9) of the furnace are bled through a duct (10) leading from the combustion chamber (9) to the interior of the hopper (5), or of the duct (1). A branch (11), controlled by a valve or damper (12), leads from the duct (10) to atmosphere to provide for admission of relatively cold air to the duct (10). A second branch (13), controlled by a valve or damper (14), and leading from the duct (10), by-passes the duct (1) and is connected to an extension (15) of the duct (1) upstream of the branch duct (2). The duct extension (15) leads to a pulverising mill (16), including a fan impeller. A duct (17), controlled by a valve or damper (18), and leading from atmosphere, is connected to the duct extension (15) adjacent to the mill (16). A duct (19) leads from the mill to a burner (20) in the combustion chamber (9), a classifier (21) intercalated in the duct (19) serving to permit passage only of pulverised fuel of the desired size. In practice, when the furnace is fired, fuel is fed to the duct (1) through which the fuel passes to the hoppers (5 and 6) and thence to the grate (1). Hot flue-gases bled from the combustion chamber (9) flow into the hopper (5), or directly to the lower portion of the duct (1), and thence through the duct (1) to the duct extension (15). During their passage through the duct (1) the hot gases scrub off and entrain particles of fuel adhering to the surfaces of the lumps or pieces of fuel, irrespective of whether the fuel is wet or dry. The particles then flow with the gases through the duct extension (15) to the mill (16) where the particles are pulverised to the desired size. Rotation of the fan-impeller in the mill (16) produces a draught which causes the pulverised-fuel to flow through the duct (19), and the associated classifier (21), to the burner (20) and also ensures an efficient flow of air and gases through the system. In order to maintain the temperature of the gases entering the duct (1) below a predetermined figure, the valve or the damper (12) in the branch duct (11) is operated to permit a controlled flow of relatively cold air to the interior of the duct (11) and then to the duct (1). The temperature of the gases entering the duct (1) is so controlled that the temperature of the gases flowing through the duct extension (15) to the mill (16) is in a temperature range of between 70 deg. C. and 120 deg. C. Where it is desired further to reduce the temperature of the gases flowing through the duct extension (15) to the mill (16), the valve or damper (18) in the duct (17) is operated to permit a controlled flow of cold air to the interior of the extension (15). To reduce the velocity of gases flowing through the duct (1), and thus the quantity of particles entrained by the gases, the valve or the damper (14) in the by-pass (13) is operated to permit part of the gases flowing through the duct (10) from the combustion chamber (9) to flow through the by-pass (13). *British Patent No. 827,233 issued to J. M. Beer. Complete specification published February 3rd, 1960.*

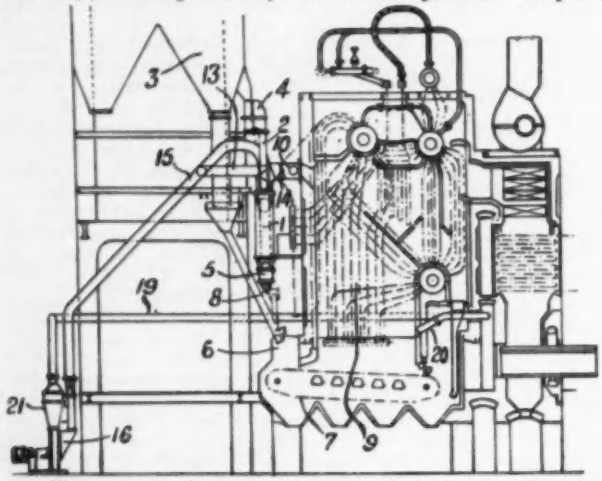


Fig. 5. British Patent No. 827,233.

Steam generator unit

In the steam generator illustrated is Figs. 6, 7 and 8, four means of burning fuel, adapted for firing with particle-fuel of a high ash-content are arranged in the form of upright cyclone furnaces (1, 2, 3 and 4), each including a cylindrical upper section such as the section (1a). A conical lower section (1b) has at its lower end a molten slag outlet (1c). The cyclones are connected at their upper ends with respective secondary furnace chambers (5, 6, 7 and 8). Each secondary furnace chamber is of circular cross-section and serves to reduce the temperature of particles of ash suspended in the combustion gases sufficiently to enable separation

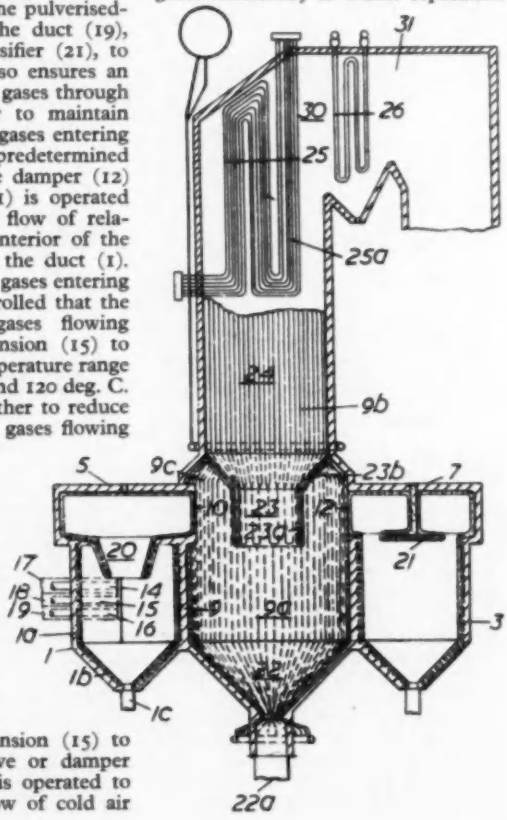


Fig. 6. British Patent No. 827,535.

of ash particles in solid form to be effected in a section (9a) of a radiation chamber. The connection between the cyclone furnaces (1 to 4) and their respective secondary furnace chambers may be by way of an upwardly and outwardly flared throat (20). The latter projects into the upper end of the associated cyclone-furnace, or around an impact plate (21), which is centrally located at the upper end of the associated cyclone-furnace chamber. The cyclone furnaces are evenly distributed around the peripheral wall (9) of the lower section (9a), having a circular cross-section, and a radiation space (9b) of vertically

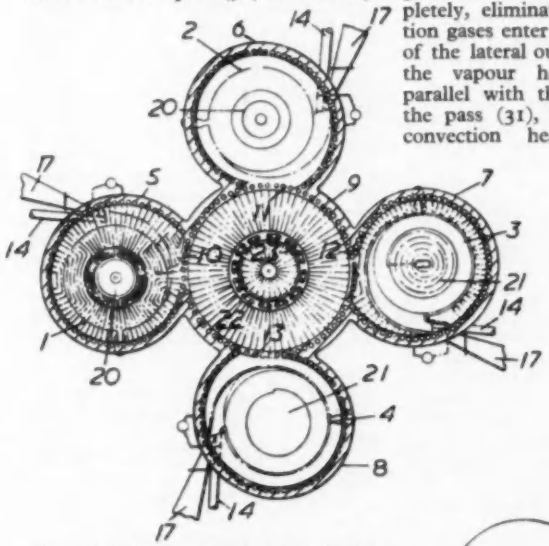
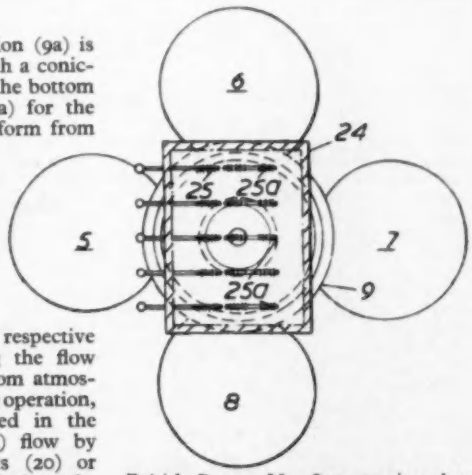


Fig. 7 (left). British Patent No. 827,535.

Fig. 8 (below). British Patent No. 827,535.

elongated form. The section (9a) is formed at its lower end with a conically shaped hopper (22) at the bottom of which is an outlet (22a) for the evacuation of ash in solid form from the section (9a) which constitutes a centrifugal-separator for the separation of solidified particles of incombustible molten slag from the furnace gases. The cyclone furnaces (1 to 4) and the section (9a) are provided at their lower ends with respective water-seals for preventing the flow of air during operation, from atmosphere into the unit. During operation, combustion gases generated in the cyclone furnaces (1 to 4) flow by way of the outlet throats (20) or around the impact plates (21) to the respective secondary furnace chambers (5 to 8), and then by way of the outlets (10 to 13) around the axis of the lower radiant section (9a) of the radiation space (9b). Molten slag deposited on the walls of the cyclone-furnaces and secondary furnace chambers is evacuated by way of the slag outlets at the bottoms of the cyclone furnaces, whilst solid ash particles separated in the section (9a) by centrifugal action are evacuated by way of the hopper (22) and outlet (22a). From the section (9a) combustion gases flow with a certain amount of whirl through the upper radiant section (24) of the pass (9b) and, at the lower end of the section of vapour heater (25), the combustion gases divide and flow in the parallel flow paths between the platens (25a) of the section (25). In these flow paths any remaining whirl in the gases is substantially, if not completely, eliminated. Thus, combustion gases enter the pass (31) by way of the lateral outlet (30) and traverse the vapour heating section (26), parallel with the horizontal axis of the pass (31), and normally to the convection heating section (26).

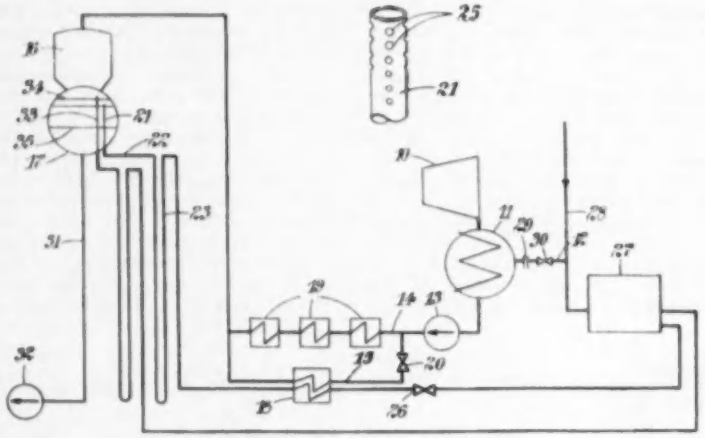


British Patent No. 827,535 issued to Babcock & Wilcox Limited. Specification published February 3rd, 1960.

Feedwater system

Fig. 9 is a diagrammatic arrangement of part of a steam generating plant for operation in association with a turbine (10). Steam from the turbine is passed through a condenser (11), and the condensate together with a continuous flow of make-up water entering through pipe (12) is fed by means of a condensate extraction pump (13) through two alternative paths (14 and 15) into a de-aerator (16) associated with a condensate storage vessel (17). The path (14) comprises a number of low-pressure feedheaters (19), whilst the path (15) comprises a counter-flow heat-exchanger (18), in which the condensate and make-up water is heated. A valve (20) controls the proportion of the flow from the condensate extraction pump (13), which passes through the counter-flow heat-exchanger (18). The condensate storage vessel (17) stores the condensate at a temperature of 250 to 280 deg. F. and has a spill-over (21) at a set level in the vessel leading into a spill-over pipe (22) incorporating a seal (23) formed by a vertical U leg to allow for variations in spill-over quantity and de-aerator pressure. This spill-over has an entry pipe with a graduated entry, as shown in Fig. 10, in which a vertical portion of pipe (21) is provided with a vertical series of holes (25) so that a rise in water level in the vessel (17) will cause an increase flow of water. The spill-over from the pipe (22) is led through the heat-exchanger (18) for heating the condensate, the flow rate being controlled by a valve (26). The flow from the spill-over, after passing through the heat-exchanger (18) and valve (26), is fed into a reserve feedwater tank (27), in which make-up water can be fed from a make-up supply pipe (28). From this tank (27), a predetermined continuous make-up is fed through pipe (12) into the condensate at the condenser (11), this flow being controlled by a suitable orifice (29) and needle valve (30). A pipe (31) from the bottom of the condensate storage vessel (17) leads to a boiler feedpump (32), which feeds the boiler (not shown) in a conventional manner. Since this particular equipment is designed for use in a system having only one boiler per turbine, and having a small water capacity in the boiler drum, a spill-over equal to only a very small fraction of the turbine steam rate need be allowed, for example of the order of 2 per cent. The capacity of the condensate storage vessel (17) above the spill-over level is made adequate to receive excess water resulting from failure of the boiler feedpump (32) during the very short time that the system can be run without the feedpump. Likewise, the capacity of the tank within the permissible limits of water-

level is adequate to cater for all fluctuations in boiler feed demands. Using the form of spill-over entry illustrated in Fig. 10, a rise of water-level would cause a greater quantity of water to pass through the spill-over (22) into the heat-exchanger (18), and so to the reserve feedwater tank (27). The increase in the water-level in the spill-over pipe would provide the necessary head. The spill-over pipe seal (23) allows for variations in spill-over quantity and deaerator pressure. The make-up needle valve (30) and the valves (20 and 26) controlling the flow rates on either side of the heat-exchanger (18), once set, need never be altered. The flow on the cold side will vary in step with the pressure drop across the feed-heaters (19). At light load, the de-aerator pressure will, however, normally be maintained by secondary heating media at a little over atmospheric pressure and the spill-over will tend to flash at some point on the discharge side of the heat-exchanger. This tendency can, however, be entirely suppressed by suitable attention to the levels of the discharge pipework in relation to the reserve feedwater tank (27). For the control of water-level when starting-up or shutting-down, in this particular layout, a separate water-sealed spill-over pipe (33), leading from the condensate storage vessel (17) (at a higher level than the spill-over) to the reserve water tank (27) is provided. During these operations, quantities of water, larger than those involved in the normal make-up or loss, require to be admitted and discharged from the system, and a manual control valve (not shown) may be provided for permitting make-up water to be fed into the condensate storage vessel or condenser. The surplus will be discharged through the separate spill-over (33). This starting spill-over (33), which need not incorporate a heat-exchanger, also serves to allow the surplus water to flow out of the condensate storage vessel (17) if any abnormal rise of water-level takes place, for example, due to admission of excessive make-up. High and low level-water alarms indicated by the lines (34 and 35) may be provided in the condensate storage tank (17) for indicating any serious departure from the normal water-level, for example, due to failure of the condensate extraction-pump or the boiler feedpump. For efficient working the reserve feed-water tank (27) should be at a substantially lower level than the de-aerator, and, if it is required, to have a supply of water at a high head to feed the boiler feedpump in an emergency, this can be supplied by pumping from the low-level feed-water tank. *British Patent No.* 828,001 *issued to Central Electricity Generating Board and J. L. Gray. Complete specification published February 10th,* 1960.



Figs. 9 and 10. British Patent No. 828,001.

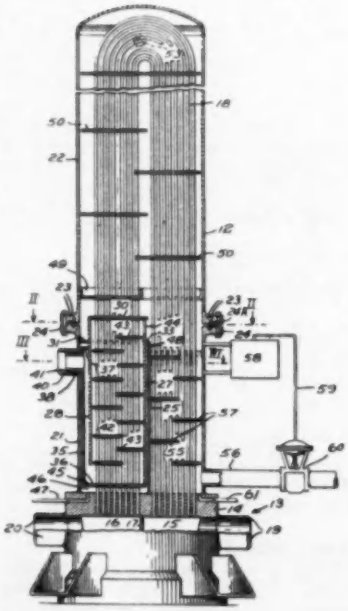
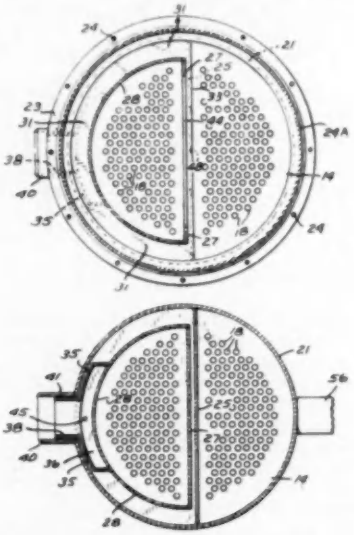


Fig. 11 (left). British Patent No. 828,680.

Feedwater heater with desuperheating section

In heat-exchangers which serve as feedwater heaters and include desuperheating sections, tubes extend through the interior of the shell of the heat-exchanger and have their ends secured to a tube-sheet. Relatively cool feedwater is introduced to adjacent ends of the tubes secured to the tube-sheet, the feedwater flowing through the portions of the tubes within the shell and being discharged through the opposite ends of the tubes. A heating fluid, for example, superheated steam, is introduced into the shell adjacent the outlet ends of the tubes and passes over the tubes in countercurrent to the flow of feedwater and in heat-exchange with it. The space and tubes adjacent the steam inlet are enclosed by shrouds to define a desuperheating section, and an outlet is provided for the latter to discharge slightly superheated



Figs. 12 and 13 (above). British Patent No. 828,680.

steam into the remainder of the shell, where the steam is condensed by passage over the tubes outside the desuperheating section. The condensed vapour collects in a portion of the shell adjacent the desuperheating section and may, or may not, pass through a sub-cooling section before leaving the shell. The discharge of the condensate from the shell is controlled to maintain a desired level within the shell. Certain problems arise in the operation of heat-exchangers having the above construction, in that the baffle structure frequently is subjected to stress corrosion by reason of the contact of the cooled condensate with the highly heated shroud and baffle structure. Also existent is the problem that stress on the tube sheet is at a maximum adjacent the discharging ends of the tubes because of contact of the superheated steam with the tube sheet which generally forms the lower end or portion of the desuper-heating section. In the feedwater heater shown in Figs. 11, 12 and 13, superheated steam is introduced into a desuperheating zone (42) through conduit (40) and liner (38) and is directed downwards by the partition (28) and then flows upwards in heat-exchange with the feedwater in tubes (18) where it loses most of its superheat. The steam then issues from the desuperheating zone (42) through the steam-outlet (44) and flows through the cut-out in the distribution plate (49) for circulation in the upper section (22) of shell (12). The condensate produced in section (22) flows into the drain-cooling zone (55), and is discharged from it through drain conduit (56). By anchoring the partitions (27 and 28) to the support plate (31), and spacing the lower edges of the partitions from tube sheet (14), the partitions can expand downwardly without causing undue stress on the partitions and on the heat-exchange shell (12). Furthermore, by isolating the sub-cool condensate in the drain-cooling section (55), from the relatively hot superheated steam in desuperheating zone (42), the ineffective transfer of heat between the zones, normally encountered in prior heat-exchangers, is reduced and the stresses, due to temperature differences, are materially reduced. It will also be seen that with the construction of the present heat-exchanger, stress on the tube sheet (14) is kept at a minimum because the superheated steam in the desuperheat zone (42) is isolated from the tube-sheet by a buffer zone (46). In addition, since the space between the desuperheating zone (42) and shell (12), and the spaces between the steam inlet conduit (40) and liner (38) are not flooded with condensate, the possibility of leakage of condensate into the desuperheat zone and back into the steam inlet conduit and piping is practically non-existent. Furthermore, the condensate cascading down from section (22) cannot come in contact with metal parts which are near the superheat temperature, thereby eliminating stress corrosion. *British Patent No. 828,680 issued to Foster Wheeler Limited. Complete specification published February 24th, 1960.*

Associated Electrical Industries Limited recently announced the following appointments. *Large Steam Turbine Department*, Mr. J. S. Hall, B.Sc. (Tech.), A.M.I.Mech.E., chief engineer; Mr. J. C. London, B.Sc., assistant chief engineer (development); Mr. A. O. Ahlquist, M.A., A.M.I.Mech.E., sales manager; Mr. N. J. Austin, A.M.I.Mar.E., assistant sales manager (contracts); Mr. C. W. J. Simons, A.M.I.E.E., assistant sales manager (tenders). *Small Steam Turbine Department*, Mr. P. D. Morris, M.I.Mech.E., chief engineer (direct-coupled sets); Mr. F. D. Roberts, Assoc.M.C.T., chief engineer (geared sets); Mr. J. Richmond, M.B.E., B.Eng., A.M.I.E.E., sales manager; Mr. J. W. Ward, B.Sc. (Eng.), A.M.I.E.E., assistant sales manager (Rugby); Mr. K. J. Fishwick, B.Eng., A.M.I.Mech.E., assistant sales manager (Manchester). *Gas Turbine Department*, Mr. F. R. Harris, B.Sc., A.M.I.Mech.E., chief engineer; Mr. H. Farrington, A.M.I.Mech.E., assistant chief engineer; Mr. F. E. Baumann, M.A., A.M.I.Mech.E., sales manager; Mr. R. D. Forester, assistant sales manager. *Mechanical Engineering Development Department*, Dr. K. W. Todd, D.Eng., M.I.Mech.E., assistant chief engineer (fluid and heat flow); Mr. H. B. Svendsen, assistant chief engineer (mechanical). *Nuclear Auxiliaries Department*, Mr. T. E. Adams, B.Sc. (Eng.), chief engineer. *Turbo-generator Department*, Mr. H. I. Wood, B.Sc., A.M.I.E.E., chief engineer (large machines); Mr. F. R. L. Creek, B.Sc. Tech., A.M.I.E.E., assistant chief engineer (large machines); Mr. J. Scott, B.Sc., chief engineer (medium machines).

* * *

Mr. L. J. Cheney has been appointed chief information officer to the office of the Minister for Science.

The latest firms to be elected to the **Scientific Instrument Manufacturers' Association of Great Britain,** 20, Queen Anne Street, W.1, are **K.D.G. Instruments Limited,** Crawley, Sussex, who are manufacturers of measuring, indicating and recording instruments principally in the field of pressure, liquid level, and temperature; and **Joyce Loebl & Co. Ltd.,** Team Valley Estate, Gateshead-on-Tyne, manufacturers of electro-optical and electronic instruments. These new members bring the total S.I.M.A. membership to 173, comprising 145 full-member firms, and 28 associate-member firms.

* * *

At Multan, the first of two gas-turbines ordered by the Pakistan Water & Power Development Authority, has recently begun to deliver electrical power. The gas turbine unit is operating on natural gas, but has been designed also to run on gas oil. The nominal rating of the unit is 5,700-kW with an ambient temperature of 40 deg. C.; but the alternators are designed for a larger output to take advantage of the extra power which can be generated at lower ambient temperatures. With an ambient temperature of 18 deg. C., an actual output of 7,400-kW has been obtained. The second gas-turbine, originally intended for Multan, is now to be installed at Hyderabad. Erection of this unit will commence shortly and will be in service later in the year. Both units—which are identical—were built in the works of **Richardsons Westgarth (Hartlepool) Limited,** to Brown Boveri designs.

* * *

Mr. W. M. Lee, Glasgow, has been appointed deputy chairman of the Electricity Consultative Council for the South of Scotland District. He succeeds **Sir Maxwell Inglis,** Bt., who is now chairman of the Council.

William Boby & Co. Ltd., Rickmansworth, recently issued a new leaflet (Publication No. 205) entitled "Water Desalting by Electrodialysis." This company have been water treatment engineers since 1875, and have, in recent years, carried out an extensive amount of research and development in connection with the conversion of saline waters by electrodialysis. This has been done in co-operation with the British Department of Scientific and Industrial Research, and its Dutch counterpart—the Central Technical Institute—T.N.O. Being the British licensees of the T.N.O. patents, William Boby & Co. Ltd. are now in a position to design and supply equipment capable of producing potable water from sources whose high dissolved salt content renders them unfit for human or animal consumption. In addition to bringing this new development to the notice of the public, this leaflet gives a brief outline of the principles underlying the process.

* * *

Ether Limited, Birmingham, have issued a new sales-leaflet describing their new Xactrol potentiometer recording controllers (series 2,000). These are high quality instruments for accurately controlling and measuring temperatures of −200 deg. C. up to +2,000 deg. C. They are equally suitable for measuring variables, such as speed, strain, pressure and hydrogen-ion concentration, as well as any other quantity that can be expressed as an electrical signal.

* * *

Mr. E. F. D. Webb, B.Sc. (Eng.), A.C.G.I., has been appointed engineering manager of Hagan Controls Limited. Mr. Webb was chief engineer of Fuel Firing Limited, from 1953-1958 and was previously technical director of Ipscol Limited.

NOTES *Personal* AND *Industrial*

English Steel Corporation Limited announce that **Dr. C. J. Dadswell** has relinquished the office of managing director, Davis & Lloyd (1955) Limited, and has been appointed chairman, and **Mr. C. Muirhead,** O.B.E., is now managing director of Davis & Lloyd (1955) Limited. Dr. Dadswell is a director of English Steel Corporation Limited, and Mr. C. Muirhead a special director.

* * *

Mr. Norman Readman, managing director, The Consolidated Pneumatic Tool Co. Ltd., London, makers of compressors and compressed-air equipment (and a wholly-owned subsidiary company of Chicago Pneumatic Tool Company, New York) has been elected to the board of directors of the New York Parent Company. Mr. Readman remains managing director of the Consolidated Pneumatic Company in London, and from there continues to be responsible for all Chicago Pneumatic's operations throughout the world, outside of the Western Hemisphere.

* * *

Mr. Barrie Heath, D.F.C., M.A., managing director, Powell Duffryn Carbon Products Limited, and a director of other companies in the Powell Duffryn Group, has relinquished his Powell Duffryn appointments in order to take up another appointment. Following Mr. Heath's resignation **Mr. R. Turner,** M.I.Mech.E., hitherto acting managing director of Powell Duffryn Technical Services Limited, has joined the board of Powell Duffryn Carbon Products Limited as deputy-chairman, and **Mr. F. W. Stokes,** a director and the present works manager of the company's factory at Hayes, has been appointed general manager.

* * *

Hagan Controls Limited—one of the Plessey Group of Companies—announce that **Mr. K. R. Sandiford,** B.Sc. (Eng.), has joined the company as general manager. Since 1954 he has been chief instrument engineer of the Development and Engineering Group of the U.K. Atomic Energy Authority.

* * *

Mr. J. N. Aldington, B.Sc., Ph.D., M.I.E.E., F.R.I.C., F.Inst.P., F.I.E.S., an executive director of Associated Electrical Industries Limited, has been appointed a director of Henley Foundries Limited, and elected chairman of the board.

* * *

Mr. E. R. Klotz, A.M.I.Mech.E., has been appointed deputy-superintendent of Stella North power station. In 1955, Mr. Klotz was appointed operating and efficiency engineer at the station, where he assisted in the commissioning of the new station, before joining the generation department of the N.E. Division at Carliol House, Newcastle, as senior assistant engineer.

Following the appointment of **Mr. R. N. Millar** as managing director of the Engineering Group of The General Electric Co. Ltd., and who will have his headquarters at Magnet House, Kingsway, W.C.2, three new appointments have been made at the company's engineering works at Erith. They are as follows:—**Dr. K. J. Wootton**—general manager of Erith Works, **Mr. C. J. O. Garrard**—deputy general manager of Erith Works, **Dr. H. K. Cameron**—manager, Atomic Energy Division, Erith.

* * *

Mr. Peter Wrightson, managing director, Head Wrightson & Co. Ltd., has been appointed vice-chairman and managing director.

* * *

Mr. J. Mackenzie-Mair has been appointed to the board of Steel, Peech and Tozer, a branch of The United Steel Companies Ltd., and has assumed the title of director and commercial manager.

* * *

As a result of the offer by Albright & Wilson Limited, for the capital of A. Boake, Roberts & Co. (Holding) Ltd., having become unconditional, **Mr. F. G. Pentecost,** chairman of A. Boake, Roberts & Co. (Holding) Ltd. has been appointed a director of Albright & Wilson Limited.

* * *

Mr. C. J. Carter, director and manager, John Thompson-Kennicott Limited (a member of the John Thompson Group), has retired after more than 50 years' service with the company. He is succeeded as director and manager, by **Mr. W. J. Jeavons,** who has been with the company for the past 15 years, and who was previously with John Thompson Water Tube Boilers Limited.

* * *

Following the recent death of **Mr. J. Kenyon,** M.Sc., chief electrical engineer, Keith Blackman Limited, for the last 13 years, **Mr. H. W. Wright** has been appointed head of the company's Electrical Department.

* * *

In order to augment their technical representation, Sir W. H. Bailey & Co. Ltd. (Albion Works, Patricroft, Manchester) has appointed **Mr. B. D. Hayes** to cover the East and West Ridings of Yorkshire. He can be contacted at 1, Ashworth Close, Bakersfields, Nottingham. (Telephone: Nottingham 24-8629.)

* * *

James Howden & Co. Ltd. have received orders for the supply of the air-preheaters, the forced-draught and induced-draught fans, and Howden-Lurgi electrostatic precipitator plant for installation with the new 400,000 lb./hr. Babcock & Wilcox high-pressure boiler for the extension of the power plant of the Ford Motor Co. Ltd., Dagenham.

The Senate of the University of London has conferred on **Mr. R. S. Edwards** (who is a deputy-chairman of the Electricity Council) the degree of Doctor of Science (Economics) for his work in the field of Industrial Organisation and cognate fields. Until recently, Mr. Edwards held the Chair of Economics (with special reference to Industrial Organisation) in the University of London, but has now resigned this appointment to concentrate on the affairs of the Electricity Council.

* * *

Mr. A. J. Wilson has joined the board of directors of Charlton Weddle and Co. Ltd., Newcastle upon Tyne. He will continue as managing director of Wilson, Taylor and Co. Ltd., 4, New London Street, London, E.C.3, which is now the London office of Charlton Weddle and Co. Ltd.

* * *

The Metal Industries Group states that, following the acquisition by Metal Industries Limited, of Lancashire Dynamo Holdings Limited, the following board changes are announced: **Sir Charles Westlake,** chairman, and **Mr. John Black,** deputy-chairman, of Metal Industries, have been appointed chairman and deputy chairman, respectively, of Lancashire Dynamo Holdings. **Lt.-Col. G. S. Marston** has resigned as chairman, managing director and director of Lancashire Dynamo Holdings. **The Earl of Halsbury** retains his office as vice-chairman of Lancashire Dynamo Holdings.

* * *

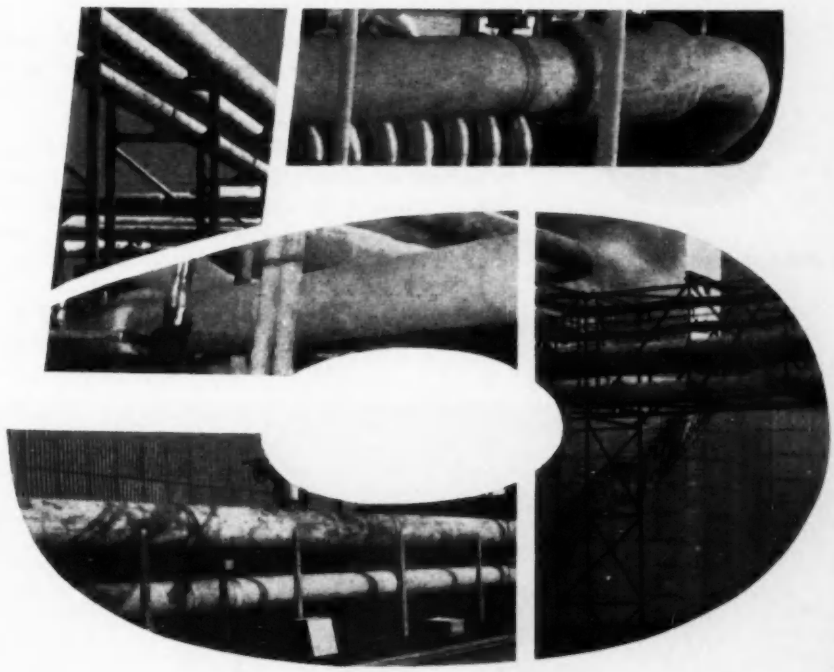
Chemical Works Projects Limited has been formed by P.G. Engineering Limited (of the Power-Gas Group), **Humphreys & Glasgow Limited** and **Simon-Carves Limited,** to supplement their normal activities by undertaking contracts for large fertilisers and chemical plant projects overseas. The joint company, thereby, will be able to call on extensive resources. The board will consist of Mr. J. P. V. Woolam, Mr. G. Gresle Farthing and Mr. R. W. Rutherford (who will be the first chairman), each having an alternate director. The registered office of the company will be Simon House, 28/29, Dover Street, London, W.1.

* * *

Babcock & Wilcox Limited have received contracts from the Central Electricity Generating Board for the supply of the ash and dust-handling plant for Thorpe Marsh power station, and for the dust-handling plant at Blyth "B" power station.

* * *

The C.E.G.B. have placed contracts with **John Thompson (Pipework) Limited** for the high-pressure pipework and valves, and with **Alley and MacLellan Limited** for the circulating-water valves for the new 360-MW power station at Richborough (Kent).



Five Miles of Steam Pipeline

To supply process steam from the new Lever Bros. (Port Sunlight) Ltd., Merseyside Power Station to other Unilever factories in the Port Sunlight area, over five miles of steam pipeline were required. Stewarts & Lloyds Ltd., who were responsible for designing and building the pipeline, called in The Darlington Insulation Co. Ltd. to undertake the task of insulating the pipe to within the calculated theoretical heat loss. As will be seen, the total heat loss is now in fact almost 10% lower than the calculated theoretical figure.

This vast project involves the transmission of 370,000 lbs of steam an hour and in one case steam travels 5,680 feet with a total heat loss of only 1,454,000 Btu/hr.

The illustrations on the inside pages show sections of this work and provide details of some of the insulation applied.

The Darlington Insulation Co. Ltd., handle the majority of insulation contracts in the power generation field. It is a very competitive business—what are the reasons for the supremacy of Darlington Insulation?
Perhaps these features help:—
i) The Company has offices in all the industrial areas of the country. This gives them the advantage of having close knowledge of local conditions and labour and enables them to prepare quick, accurate estimates that eliminates costly amendments and modifications.

5

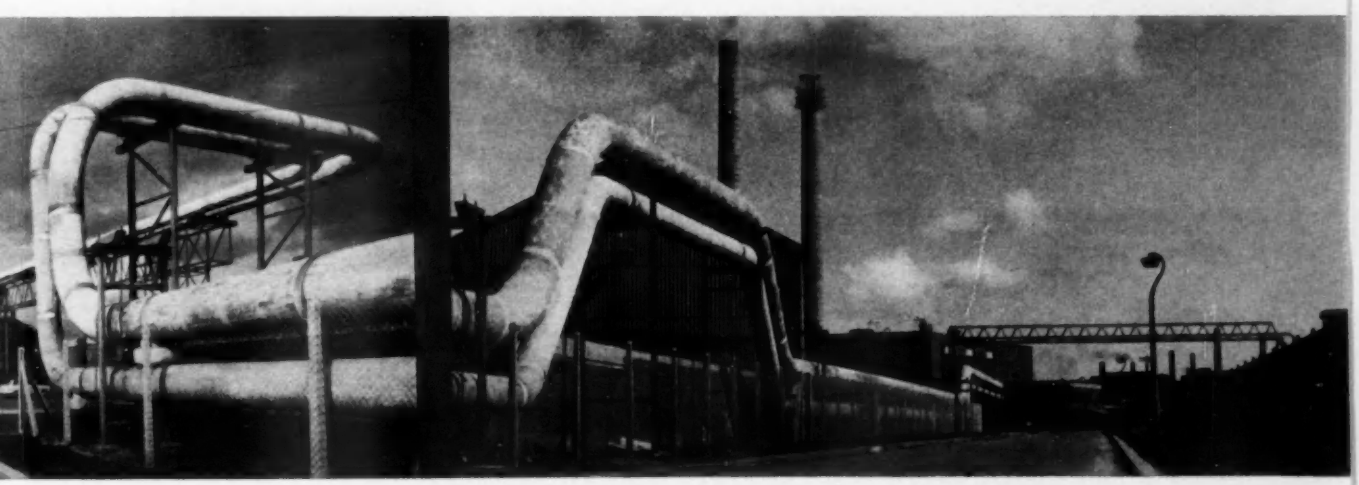
Five Miles of Steam Pipeline

The largest section of pipeline is a twelve inch main carrying steam at 230 p.s.i. and 620°F a distance of 5,680 feet. Over this section a theoretical heat loss of about 1,600,000 Btu/hr was anticipated. The Darlington Insulation Co. Ltd., recommended this treatment.

2,282 feet—1" *Metadextramite* 3⅛" *Magnesia** ¼" *Armouring Compound A.C.1**. *This compound is weatherproof and needs no painting.* 3,578 feet—1" *Metadextramite** 3½" *85% Magnesia** ½" *Hard Setting Composition** *and roofing felt.*

In practice, the insulation has enabled the total heat loss to be reduced to only 1·3% of the designed heat transmission. This achievement by Lever Brothers has revealed the opportunities that exist for the economical transmission of steam over great distances and makes planning of steam raising plant much more flexible.

*All these products are made by The Chemical & Insulating Company Limited—another member of the Darlington Group of Companies.



ii) The Darlington Insulation Co. Ltd., provides a complete technical advisory service, and is famous for its efficiency and close co-operation on site.

iii) Darlington insulation is applied by craftsmen: it is better finished and costs less to maintain.

iv) The Darlington Insulation Co. Ltd., has a fine record for completing awkward and unusual contracts efficiently: it is the first name to spring to mind when insulation problems arise.

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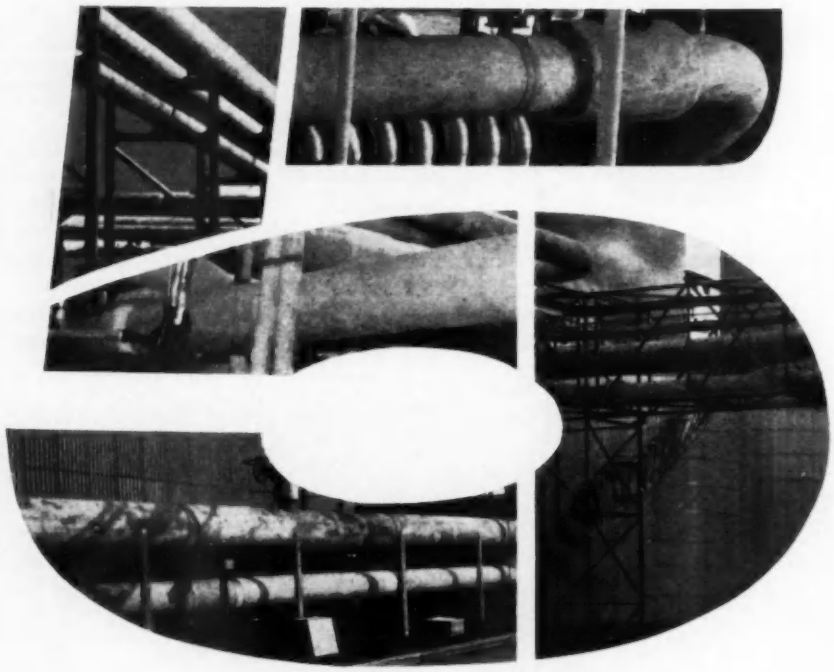

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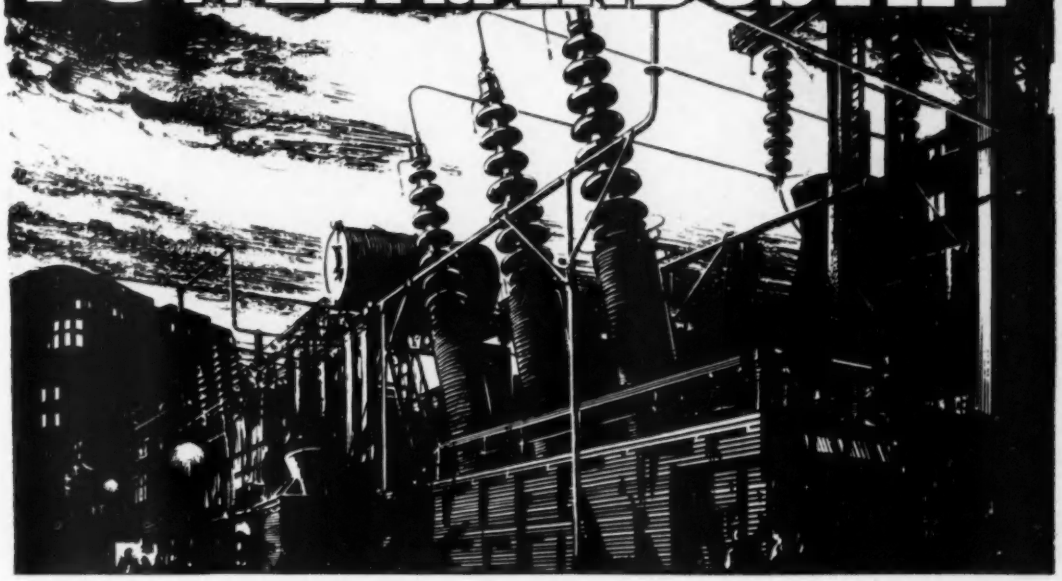

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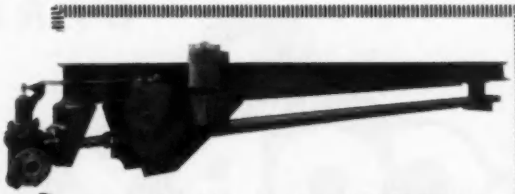

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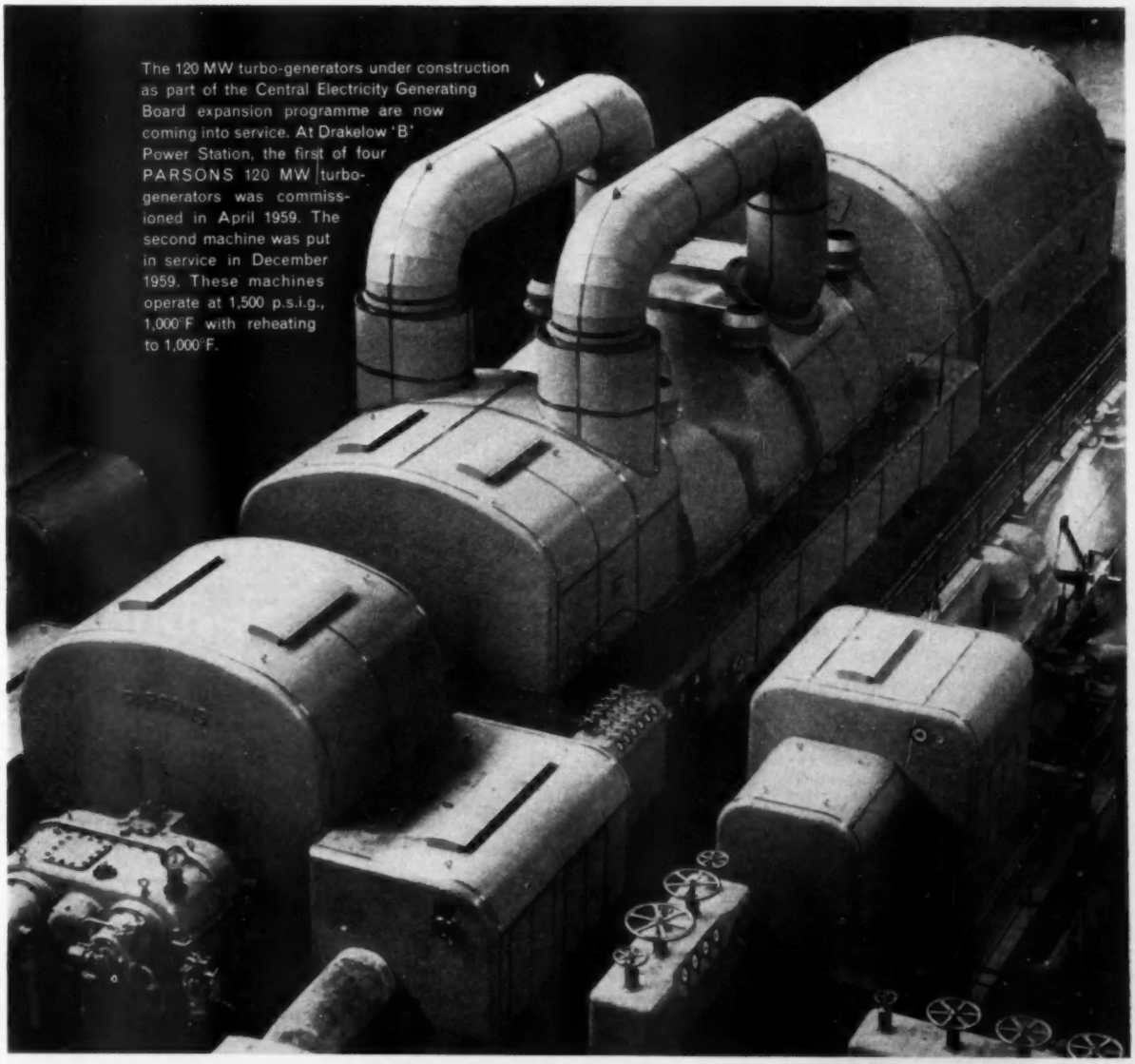

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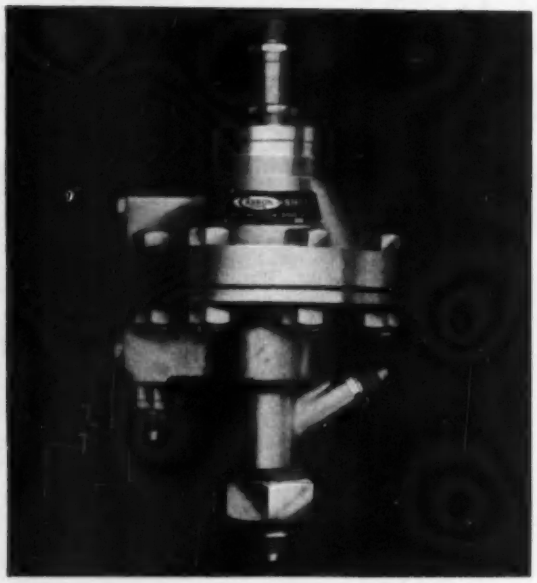

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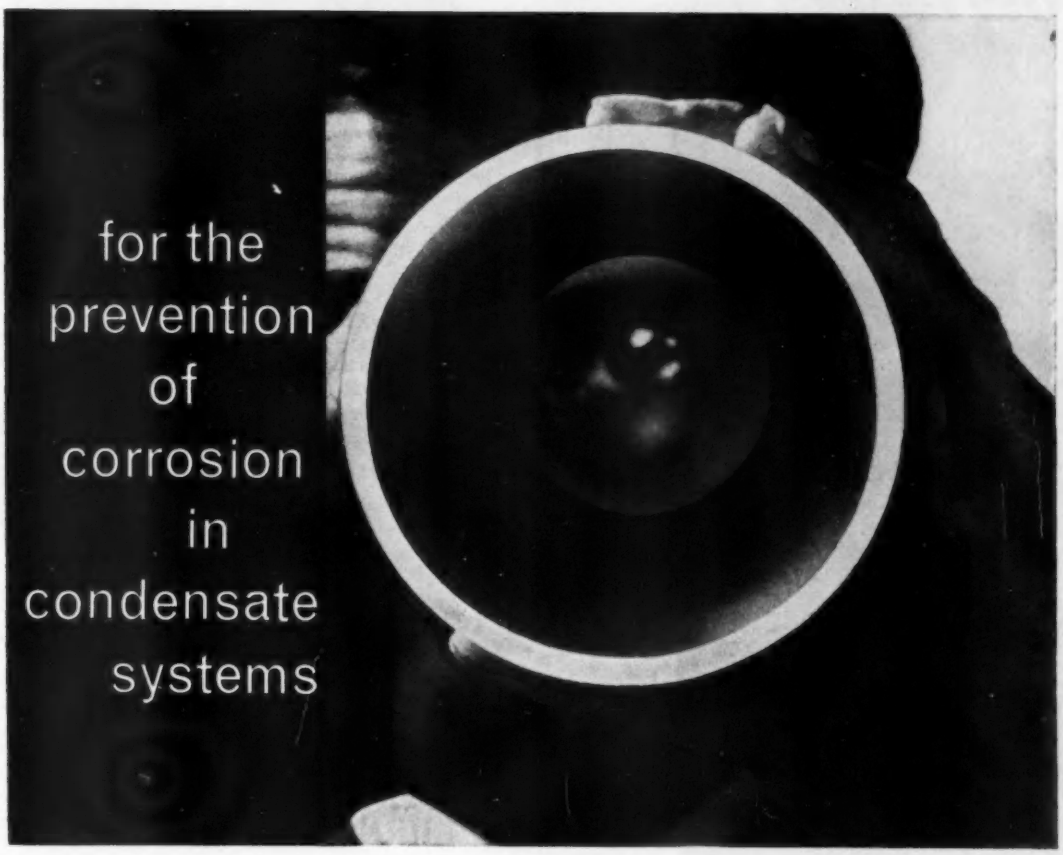

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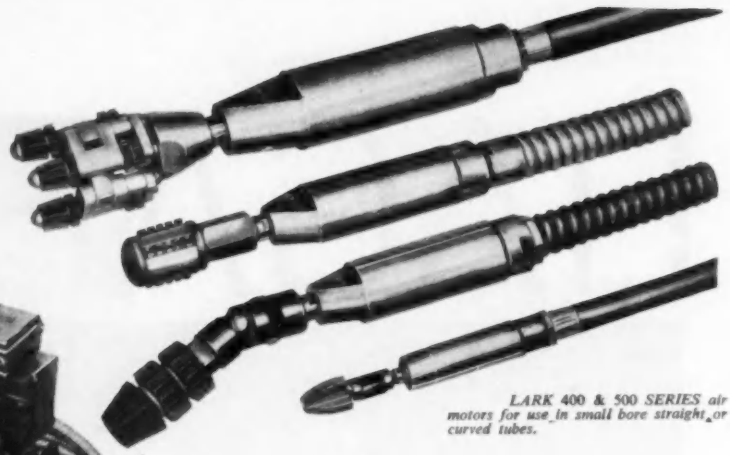

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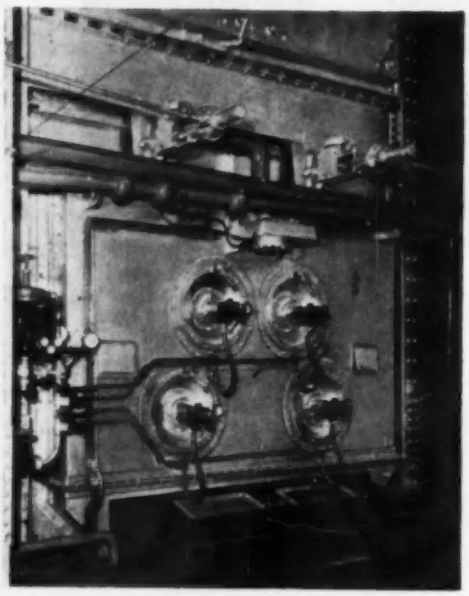

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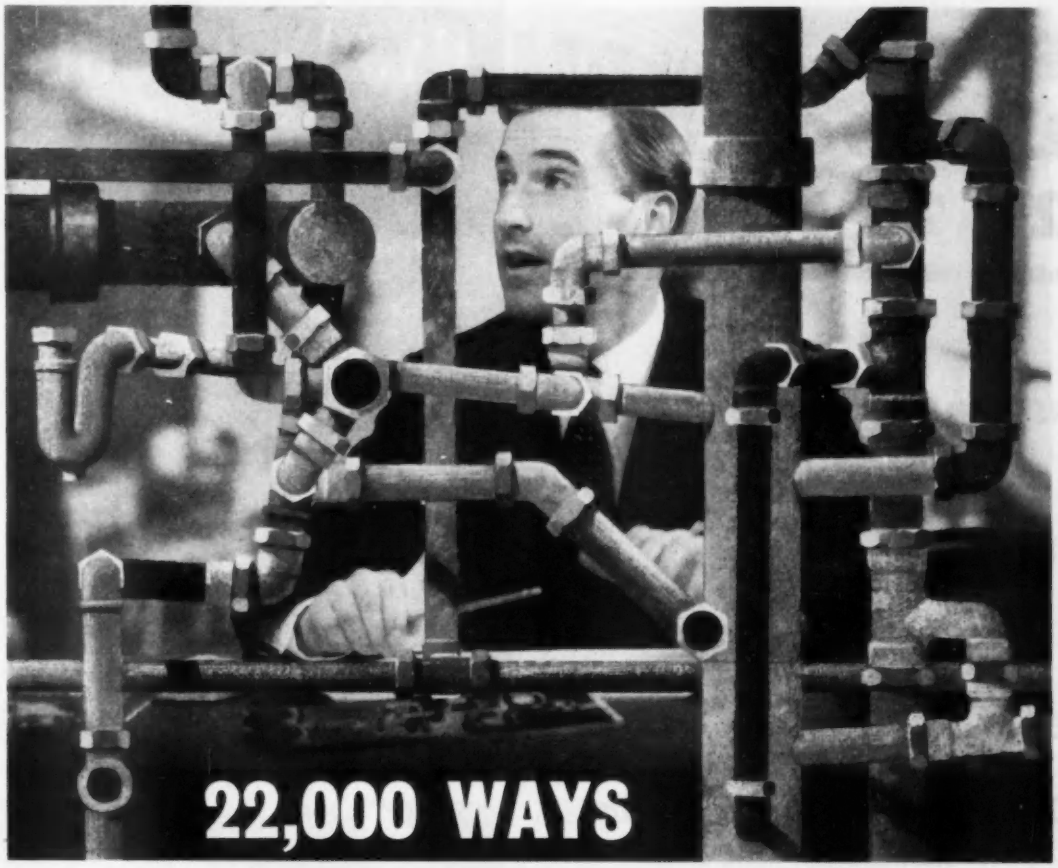

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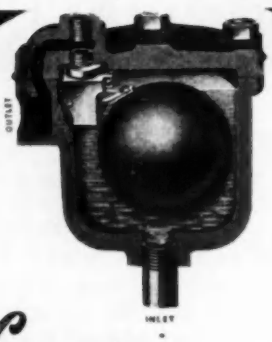

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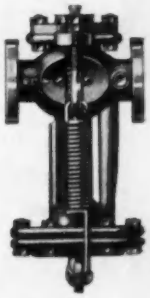

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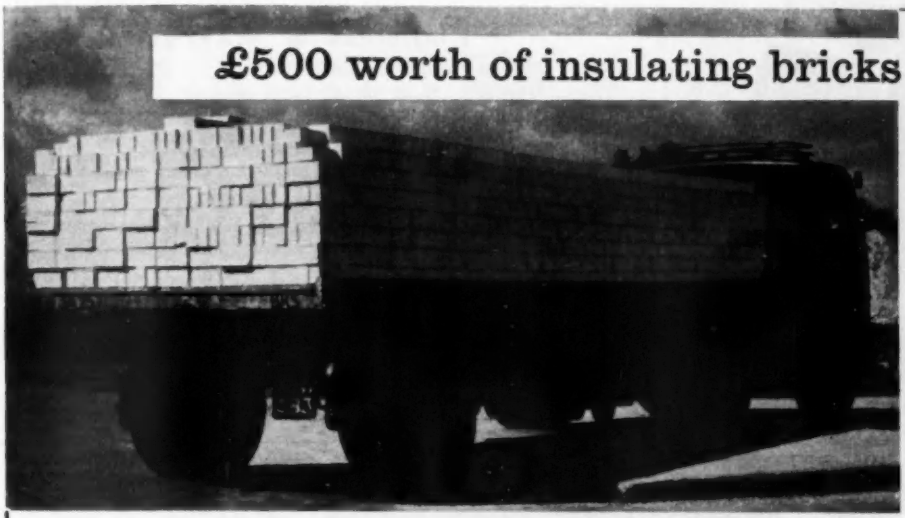

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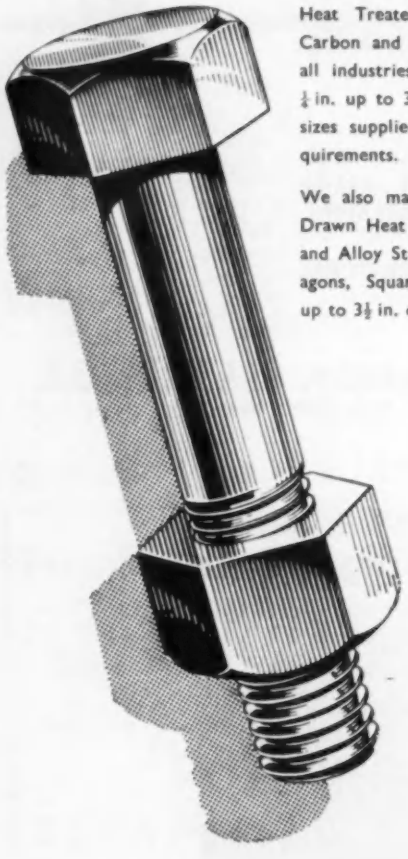

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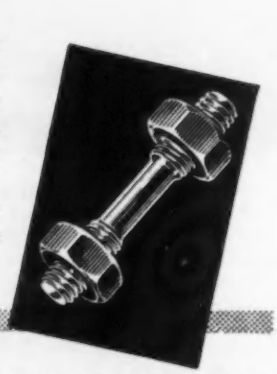

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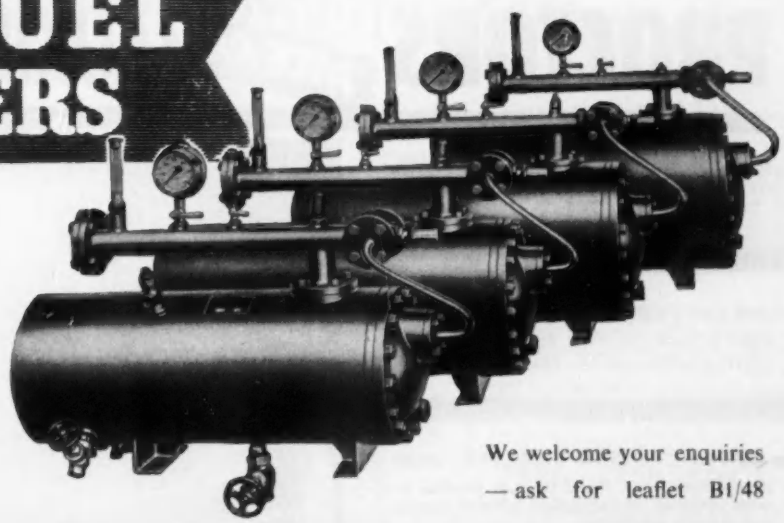

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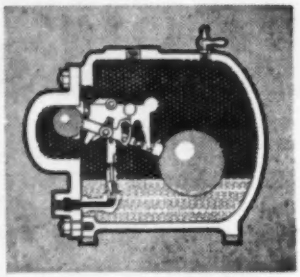

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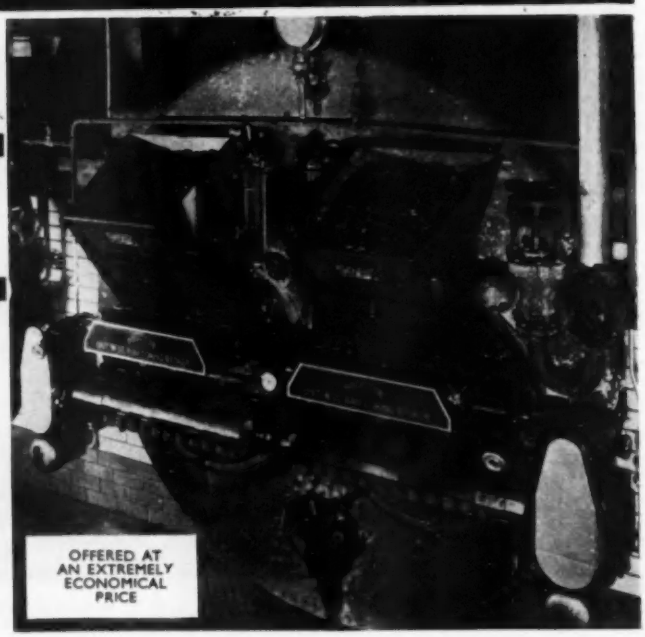

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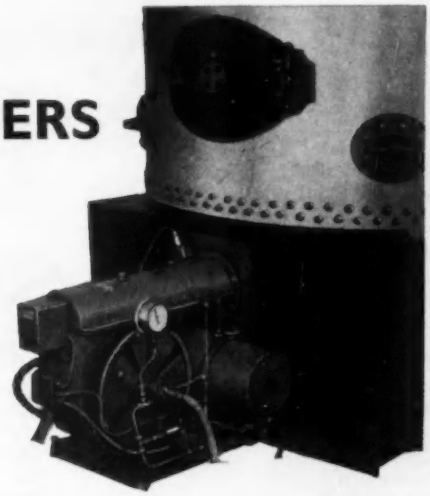

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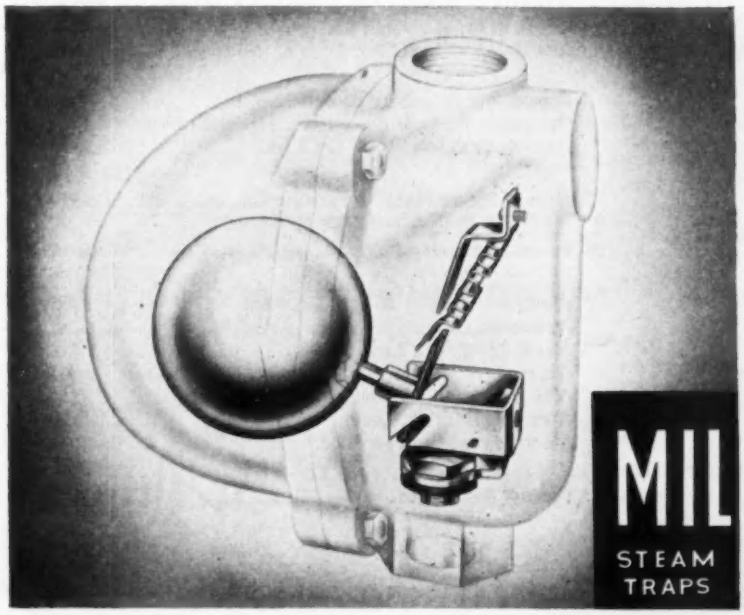

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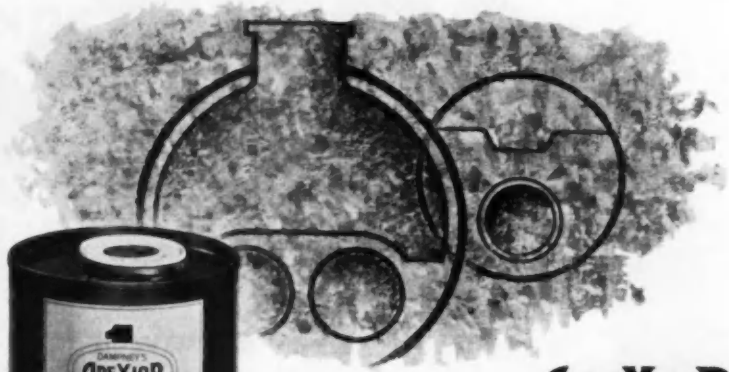

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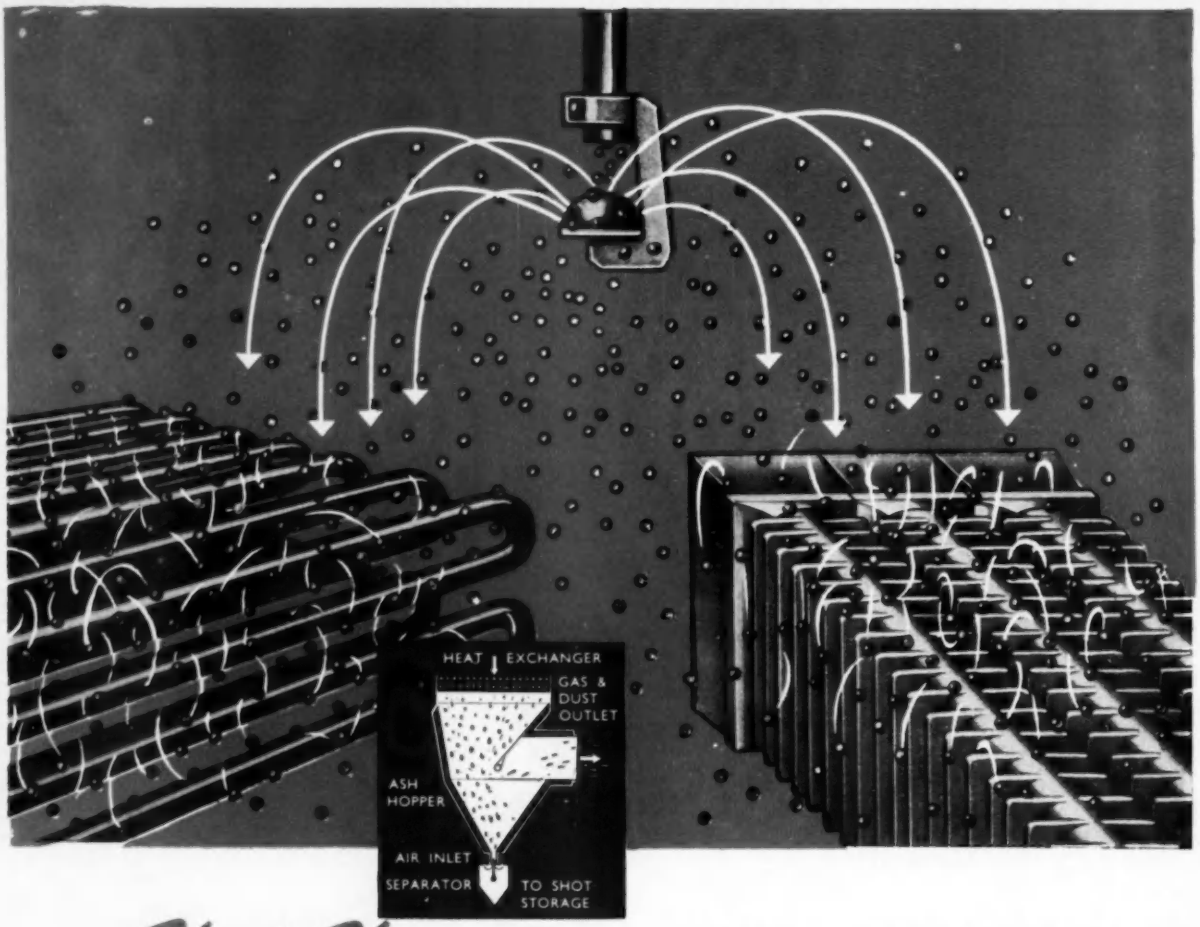

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